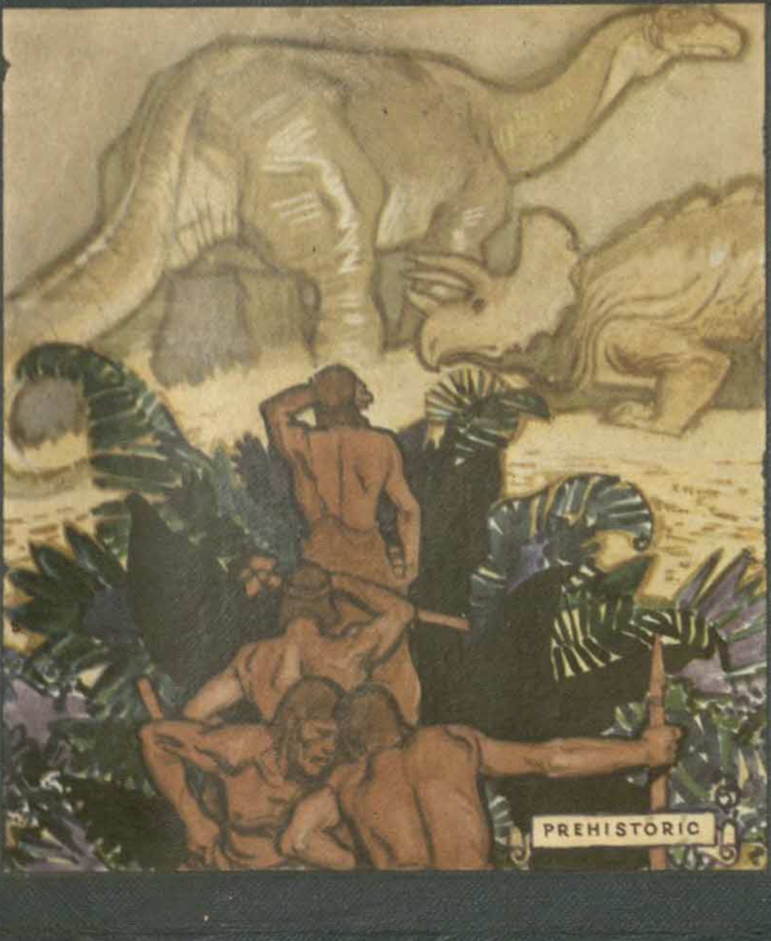
THE WONDERLAND OF KNOWLEDGE



E=mc²
EINSTEIN

2291

D/127

~~5796~~

~~5796~~

2291
SENIOR [illegible] TRAINING COLLEGE
BAN
D/127

THE WONDERLAND OF KNOWLEDGE

The Pictorial Encyclopedia

1961

Editor in Chief—EVERETTE EDGAR SENTMAN
B.S., University of Illinois; Drake U., Loyola U., American Conservatory
Writer, Lecturer; Author, "The Encyclopedia—A Key to Effective Learning and Teaching"

Former Editors in Chief—GORDON J. LAING
Ph.D., LL.D., Litt.D.
Former Dean, Division of Humanities, University of Chicago

HARRY ORRIN GILLET
B.S., University of Chicago
Former Supervisor of Education, Museum of Science and Industry, Chicago
Principal Emeritus of the University of Chicago Laboratory School

Managing Editor—ASHER J. BIRNBAUM
Ph.B., University of Chicago; B.A., Northwestern U.

Associate Editors—RODERICK M. GRANT
A.B., Beloit College
Managing Editor, *Popular Mechanics*

VALETA WISURI
A.B., LL.B., Washington University

Science Editor—ELIZABETH R. JOHNSON
B.S., St. Ambrose College; Former Control Laboratory Analyst, Abbott Laboratories;
Patent Abstracter, Internatl. Minerals and Chemical Corp.

Art Director—RICHARD K. GORSKI
M.S., University of Wisconsin
Art Education Specialist

Picture Editors—JAMES POYNTON
Ph.B., Loyola University

RALPH W. MILLER
Ph.B., University of Chicago; Formerly of International News Photos

Production Manager—CROSBY J. LISKE
Graduate, Art Institute of Chicago

Director of Educational Research and Services—VICTORIA S. JOHNSON
Special Studies, Northwestern University, American Conservatory
Assistant Director, The Chicago Tribune Miracle of Books

WONDERLAND OF KNOWLEDGE CORPORATION

THE BOARD OF EDUCATORS

This distinguished advisory body enriches The Wonderland with sound educational techniques, important facts, and significant meanings.

SELMER H. BERG, M.A.
Superintendent of Schools
Oakland, California

KARL BERNHARDT, Ph.D.
Professor of Psychology and
Assistant Director, Institute for Child Study,
University of Toronto

A. J. BRUMBAUGH, Ph.D., LL.D., L.H.D.
Consultant for Research, Southern Regional
Education Board, Atlanta; *Formerly Dean,*
University of Chicago; Director, Programs
Branch, U. S. Office of Education

FRANCIS KEPPEL, B.A.
Dean of Graduate School of Education
Harvard University

E. T. McSWAIN, Ed.D.
Dean and Professor of Education
School of Education
Northwestern University

WILLIAM VAN TIL, Ph.D.
Chairman of Department of
Secondary Education, Professor of
Education, New York University

Chairman
CAREY CRONEIS, D.Sc., Ph.D., D.Eng.
Provost of William Marsh Rice University,
Houston, Texas;
Formerly President, Beloit College

~~8044~~ 6344

PRONUNCIATION

The pronunciation of titles is indicated by accenting the word or by respelling it phonetically in italics. In the phonetic spelling, letters are used to indicate the sounds which they most commonly represent.

A vowel is *short* when followed by a consonant in the same syllable, unless the syllable ends in silent *e*.

A vowel is *long* when the letter occurs in a syllable which ends in silent *e* or when ending an accented syllable.

The hard sound of *c* is represented by *k*.

The hard sound of *s* is represented by *z*.

The foreign sounds which have no equivalent in the English language are represented as follows:

N for the French *n*, as in Breton: (**Breton,** *bre toN'*).

ö for the German *ö*, as in Göttingen: (**Göttingen,** *gö' ting en*).

ü for the German *ü*, as in Blücher: (**Blücher,** *blük'ur*).

Copyright© 1937, 1940, 1942, 1944, 1945, 1946, 1949, 1950, 1951,
1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961

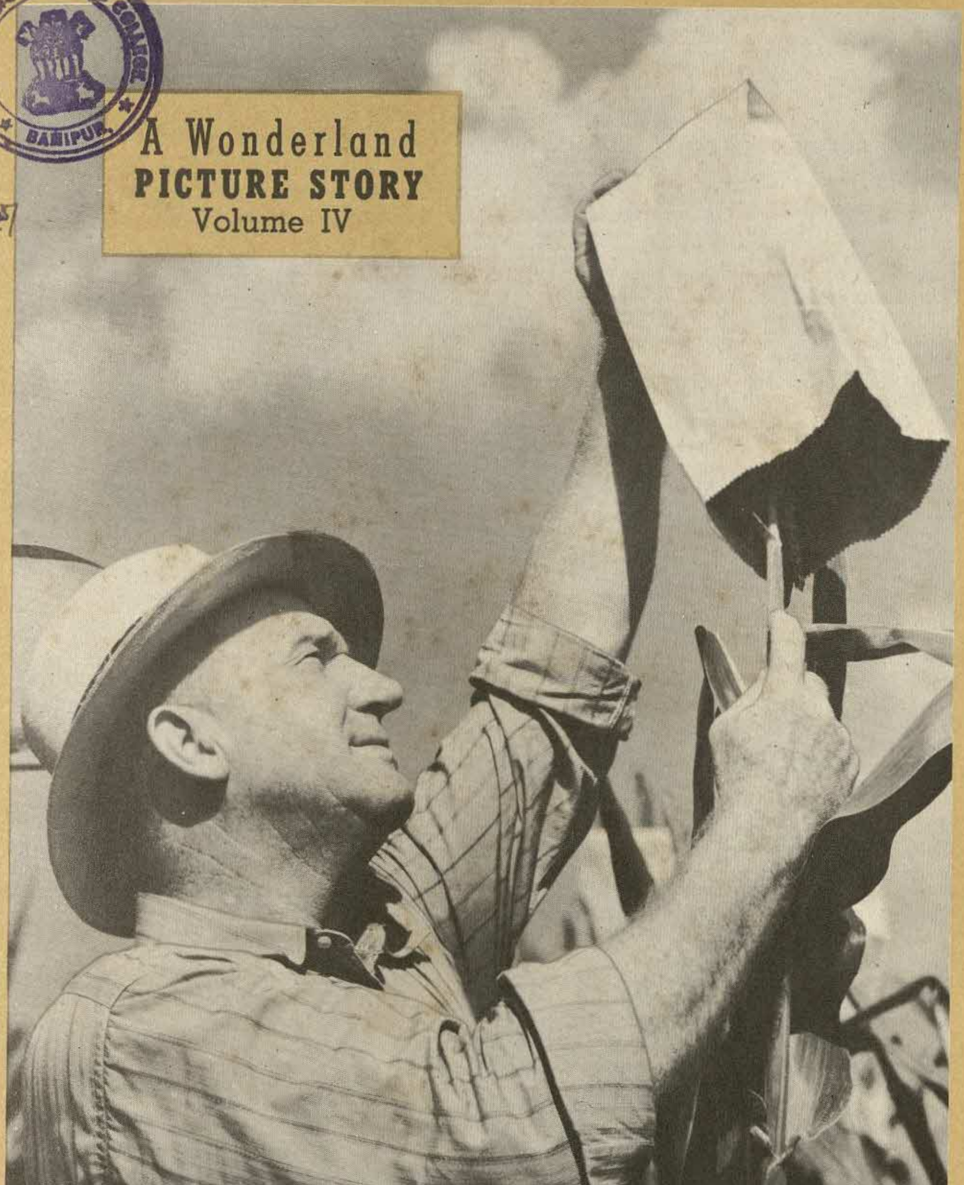
PUBLISHERS PRODUCTIONS, INC.
Tangley Oaks Educational Center
Lake Bluff, Illinois

Printed in the United States of America

Library of Congress Catalog Card Number: 61-5907

~~2294~~
SENIOR BASIC TRAINING COLLEGE
BANKIPUR.

A Wonderland
PICTURE STORY
Volume IV



Dekalb Agricultural Association

CORN. Breeding of corn produces hybrid varieties that increase corn yield and quality and that can withstand unfavorable growing conditions. It is done by cross-pollination. See page 1040.

A few FACTS *from* Volume IV

Why does the outside of a glass of ice get wet in a warm room?

Water vapor in the atmosphere condenses on the cold surface of the glass. See CONDENSATION.

What signs of land were first seen by his crew as the ships of Columbus neared the New World?

Branches of trees, floating on the sea, and land birds cheered the anxious sailors of the little fleet. See COLUMBUS, CHRISTOPHER.

Why do engineers sometimes run refrigerating pipes through the concrete forms of a construction job?

Concrete heats up during the first stages of hardening and, when poured in large masses, must be artificially cooled to cut the time required for setting. See CONCRETE.

How much do criminals cost the people of the United States every year?

Judging by the cost of law enforcement, authorities place the annual cost of crime in the United States at more than fifteen billion dollars. See CRIME.

Is the sea lily vegetable, animal, or mineral?

The jointed stems and feathery appendages of the Crinoidea make them appear to be flowers growing on the bottom of the ocean. They are really sea animals of a once widely distributed group. See CRINOIDEA.

What famous story book is regarded as the first English novel?

Robinson Crusoe, by Daniel Defoe, is the first English novel, according to modern interpretation of the term. The book appeared in 1719 and made its fictitious characters seem so real that it quickly won great popularity. See DEFOE, DANIEL.

What is the foremost fiber plant of the world?

Cotton. This is one of the world's four greatest crops, second in importance only to such vital food crops as wheat, corn, and potatoes. Cotton's influence extends to political, industrial, and social affairs. It has a large share in ruling the daily lives of mankind. See COTTON.

What North American bird has a windpipe eight feet long?

The whooping crane has a long, coiled windpipe which fits into the crevices of its breastbone. For this reason, the bird's distinctive cry is peculiarly resonant. See CRANE.

How did the Chinese tell time, 6,000 years ago?

They used the water clock, an arrangement of vessels in which water from an elevated container slowly dripped into jars below. This primitive clock was "wound" at the end of the day by dumping the liquid caught by the lowest container back into the top jar. See CLOCK.

Why is the coconut tree so valuable to man?

Because it provides shelter, soil anchorage, and scenic beauty; also fine wood, used for furniture and certain ship fittings; food for man and beast in the meat, milk, and oil of its fruit; thatch for roofs and fiber for brooms, mats, and rope; sap, from which vinegar and yeast may be made; and raw materials for the manufacture of candles, soap, perfume, glycerine, and many similar products. See COCONUT.

What is believed to be the first metal used by man?

Owing to its wide distribution, to the ease with which it is reduced from its ores, and to its being hard enough to make good weapons and tools, copper was one of the first metals used by the human race. Copper and tin make bronze, and the Age of Bronze was the next step in civilization above the Stone Age. See COPPER.

Where is the "Corn and Hog Belt"?

One of the richest and most famous agricultural areas in the world, this belt is the fertile area of Midwest United States, the upper Mississippi Valley. Here the raising of corn and livestock dominates all agricultural industry. See CORN.

When did surnames for men first come into general use?

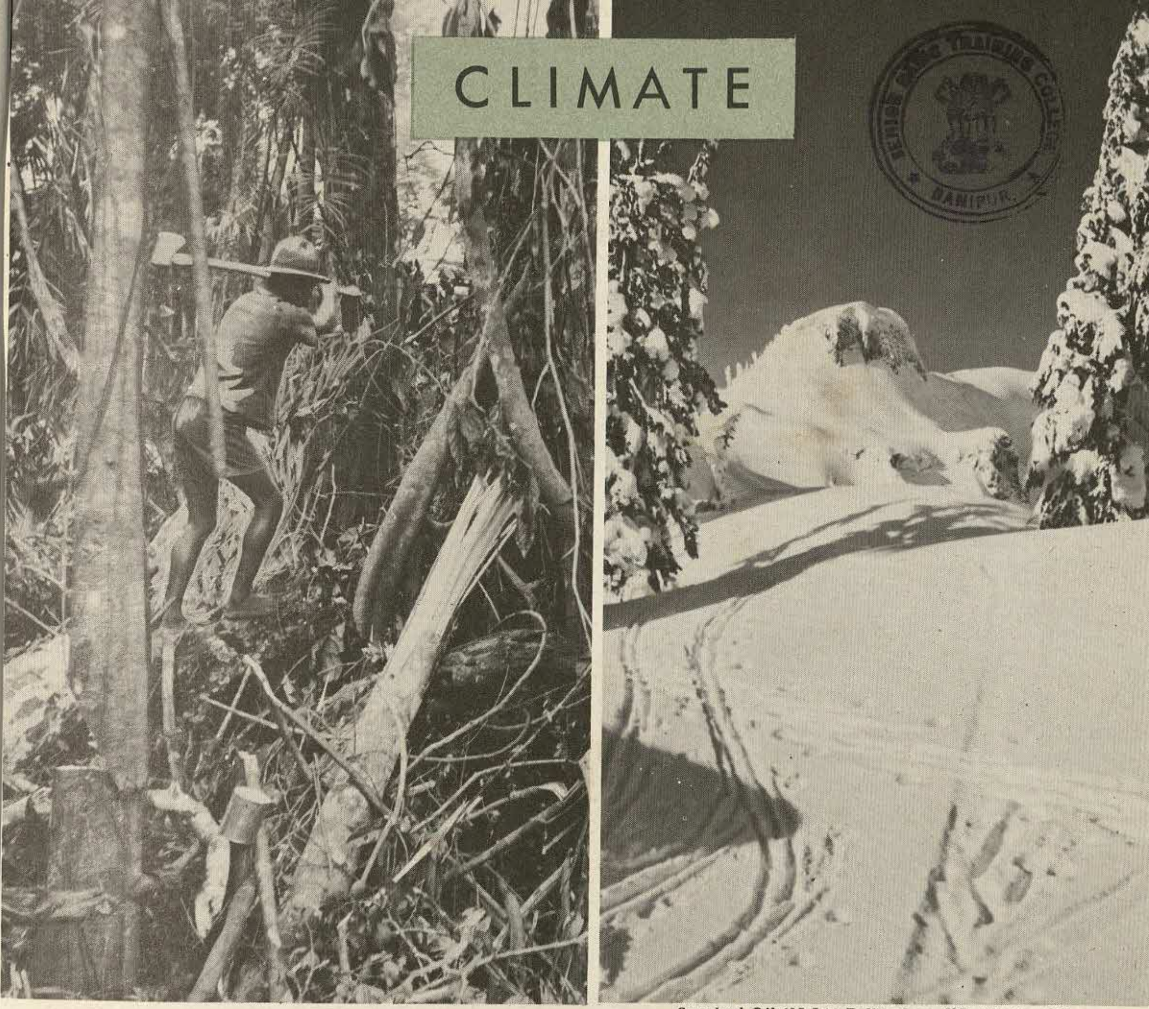
During the Crusades, thousands of armored knights traveled to the Near East to fight the infidels. Through an elaborate system of heraldry, they recognized each other by means of banners and shields displaying individual armorial bearings. There were among them, however, so many with similar first names, like John, Henry, Godfrey, etc., that further identification, through use of second names, was widely adopted. See CRUSADES.

For what work was the dachshund originally bred and trained?

This oddly shaped dog, now a popular household pet, was originally trained to hunt and capture burrowing animals, like badgers. See DACHSHUND.

CLIMATE

TRAINING
MANIPUR



Standard Oil (N.J.); Bellingham (Wash.) C. of C.

HOT AND COLD CLIMATES

In tropical lands (left) dense growth barricades the land against man's conquest. In the cold far northern and far southern lands (right), vegetation is sparse and man must make use of every resource to survive.

CLIMATE. Man's entire way of life has been deeply affected by climate. It has been an important factor in determining his physical characteristics, the type of food he eats, and the shelter he builds. It has influenced his dress and customs, his occupation, and culture in general.

Climate is the reason why the Bedouin of Arabia and North Africa wears clothing that will protect him from the intense sun and heat, and why the Eskimo wears furs to keep out the cold. It is true that in some cold regions, notably Tierra del Fuego, an archipelago south of South America, the people have become resistant to cold and wear little clothing, but, in general, warm clothing is the rule in severe climates. That December and January are cold in Chicago and warm in Buenos Aires is another climatic fact.

Climate is really weather — not the weather of a day, a month, or a year, but the sum total and average of weather conditions existing for decades. Two days of sunshine and one of rain would not describe the climate of a region unless this happened regularly. But, should the same region have many days of sunshine every year for many years, with rain coming at a certain time each year, we know that this would be one of the climatic characteristics of the place. The climate of a region does not change suddenly; it may change, but only over long stretches of time.

What Determines Climate. There are several factors that control the climate of a country or region. These include latitude, altitude, distribution of land and water, moisture, ocean currents, and prevailing winds. Of these, latitude is the most important, for it exerts the greatest effect on temperature. Latitude is the angular distance north or south of the earth's equator. Since the sun's rays strike the equator most directly the year around, it is usually the hottest there. Farther north and south, the sun's rays become more and more oblique; so the farther north or south one goes, the less heat there is from the direct rays of the sun. Therefore, a country in a latitude close to the equator, usually has a warmer temperature than one farther away.

If the earth were perfectly level, we could draw a straight line at each parallel of latitude, and the temperature at each point on this line would be the same as that at every other point on the line. The earth, however, is not level. It has mountains and valleys, oceans and lakes, rivers, canyons, and plateaus. These affect the climate; and quite apart from the directness of the sun's rays, the heat of a region is governed by these other factors. We know that, on the average, the higher we go up a mountain, the colder it gets. Thus a mountainous region on the equator might have a climate similar to that of a level region farther north or south.

Land and water also are climatic controls. The sun's rays heat water more slowly than land surfaces. In regions near large bodies of water, the temperature of the land is modified. For this reason, the Great Lakes cities have milder winters and cooler summers than those on the plains.

Moisture is also a factor of climate. The amount of moisture in the air depends partly on temperature, for warm air holds more moisture than cold. The wind, which is caused by changes in air temperature, is the chief carrier of air moisture. Ocean currents affect the climate of many regions in the world. England, situated between the latitudes of 50° and 60° north, is as far north as Hudson Bay in Canada, and if it were not for ocean currents, would have the same frigid winters. It, however, has milder winters than New York, 10° farther south, because the prevailing wind sweeps over the warm North Atlantic Drift, which passes near its shores.

Climates of the World. It is customary to classify climate according to *zones,* or broad belts. These are called *climatic zones.* The most familiar five are the torrid zone, the north and south temperate zones, and the north and south frigid zones. The *torrid,* or *tropical,* zone extends to equal distances to the north and south of the equator, and is bounded by the Tropics of Cancer and Capricorn. The *temperate* zones extend to the Arctic and Antarctic Circles. Beyond these circles are the *frigid,* or *polar,* zones. The basis for the divisions of the world into these zones is the amount and intensity of sunlight received throughout the year. Thus the tropics have the least variation in intensity and amount of sunlight, while the frigid (or polar) zones have the greatest variation.

Each zone, however, has its own peculiar climatic conditions, which influence the economic conditions of the regions in it.

The torrid zone actually embraces a number of climates, marked at one extreme by the rainy tropical season and at the other by the desert tropical climate. The rainy tropical climate is monotonously humid and hot. The temperature range between the warmest and coolest months is only two or three degrees. In a desert tropical climate, rain occurs only occasionally, usually in torrential downpours. The range between the warmest and coolest months may be as much as forty or fifty degrees. A monsoon climate has a marked rainy season, during which most of the annual rainfall occurs.

The temperate zones have the most variable weather. Their range of temperature is more than 100 degrees. Rainfall also varies greatly according to the region, but, in general, western coasts have more rainfall than

IT'S CLIMATE THAT DOES IT

Top, palm-shaded homes in the broiling tropics. Left, an Algerian woman wrapped up for protection against the sun. Right, what the well-dressed Eskimo wears—leather and fur.

interiors of continents. However, the people of the temperate zones are generally the most energetic and most advanced of all the people in the world. All the powerful nations are in these zones. They are also the greatest producing zones, though the possibilities of tropical agriculture are greater. Seasons in the temperate zones are dependent on temperature, and are very important in the life of man here, since they act as a tonic. In the temperate zones, man develops physically and mentally, because the conditions are neither too easy, as in the tropics, nor too hard, as at the poles.

The frigid zones have the sparsest population because of the extreme cold and long period of darkness.

Classification. The classification of the earth into zones gives only very general ideas of the climate to be found within each zone. Oceans and continents, lowlands and highlands, respond to the same sunlight so differently that each zone has many diverse climates within its borders. These climates are usually designated as *marine* or *oceanic; continental; littoral* (coastal); *desert; monsoon;* and *mountain and plateau* climates. Each one differs markedly from the rest, as explained in the following paragraphs:

Marine climate, characteristic of some islands in the open sea, is generally equable because of the tempering and moisture-giving influence of the ocean. Its temperatures are little disturbed by seasonal changes; there is plenty of cloudiness and rainfall. The late summer is warmest; the early winter is wettest, for then the moisture-laden winds off the ocean, which are still warm because of its slow cooling, are most rapidly cooled on going ashore.

Continental climate is generally one of extremes. In the northern hemisphere, for instance, its coldest month is January and its warmest is July, while its daily and seasonal ranges are very great. There is much less cloudiness in the continental climate than in the marine. The rainfall in general decreases as one goes inland, but the local distribution of rainfall depends on prevailing winds and the accessibility of sources of moisture, especially of large bodies of warm water. Because of friction, surface winds in the continental climate are somewhat lower in velocity than those in the marine climate.

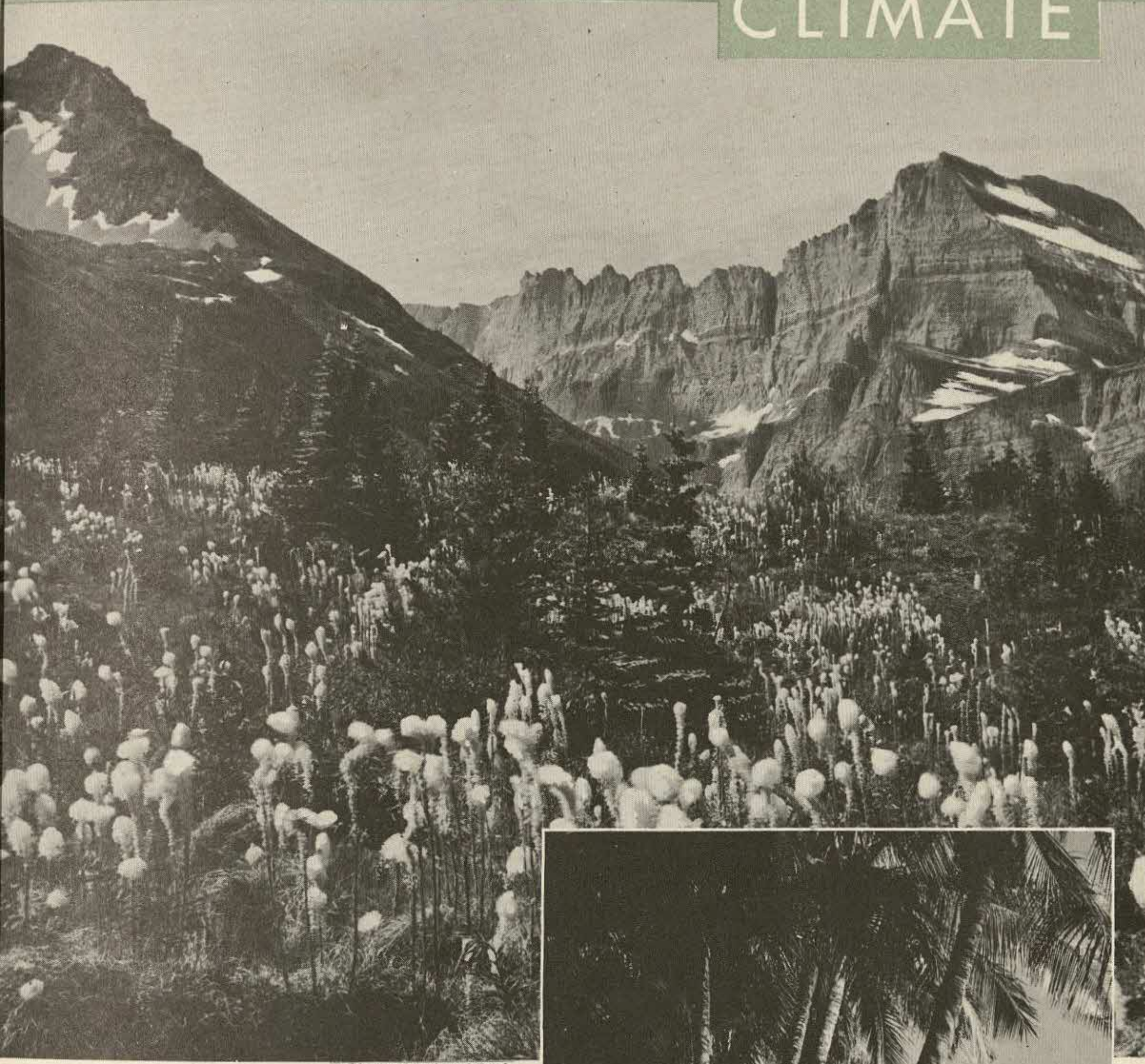
Littoral (or coastal) climate is a combination of the pure marine and the pure continental climate. On the coast, the prevailing winds govern the climate to a very large extent. While the wind is off the ocean, the climate is marine in character, and while the wind is off the land, the climate is continental. Thus the relative frequencies of continental and marine winds on a coast must be known if one is to appreciate the type of climate it enjoys.

Desert climate is extreme continental climate. Desert air is notably free from microorganisms. The daily and seasonal variations in temperature are very large. High winds are common in the daytime and occasionally become so violent that sand and dust storms occur; that is, sand is picked up by the wind and carried for long distances in the form of clouds. The nights are usually cool and quiet and free from dust. Plants in this region protect themselves from animals by means of thorns, and their leaves are hard and shiny to insure slow loss of water by transpiration.

Monsoon climate occurs in the regions where the great seasonal winds, the monsoons, are in control. India is a very good example of this type. The northern half of India has three seasons: one cool, during the winter monsoon; one hot, in the period after the winter monsoon; and one wet, during the summer monsoon. The winter monsoon is offshore, thus giving a cool, dry, continental climate in that season, while the summer monsoon is from the ocean, giving a muggy, rainy, marine climate in summer.

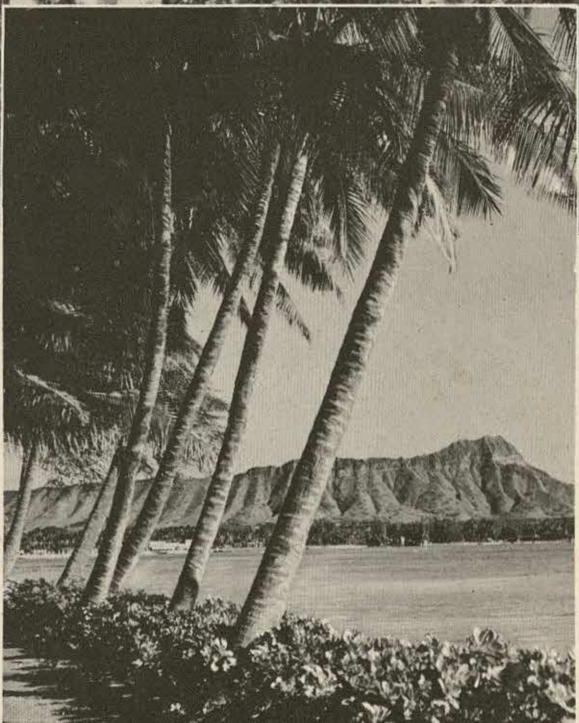
Mountain and plateau regions, by reason of their height, are usually colder and wetter than surrounding lowlands, and on account of their rough topography have great diversity of climate. Mountain ranges also act as climatic barriers, especially when lying across the path of the prevailing

A WONDERLAND ADVENTURE WITH CLIMATE



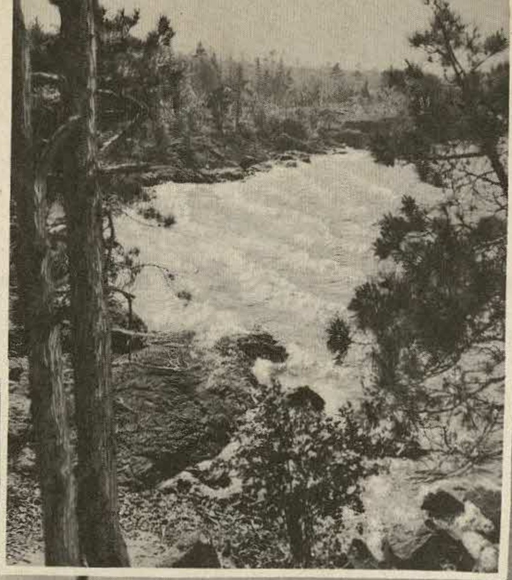
Glacier National Park

MOUNTAINS GROW OLD. Rugged, tall mountains grow old from erosion. Water, glaciers, wind, sunlight, and freezing wear them down to rounded hills.



Matson Line

LAND OF PALMS AND FIRE. Tropical palms sway in the gentle Hawaiian breezes on land built by fiery volcanoes in the middle of the Pacific.



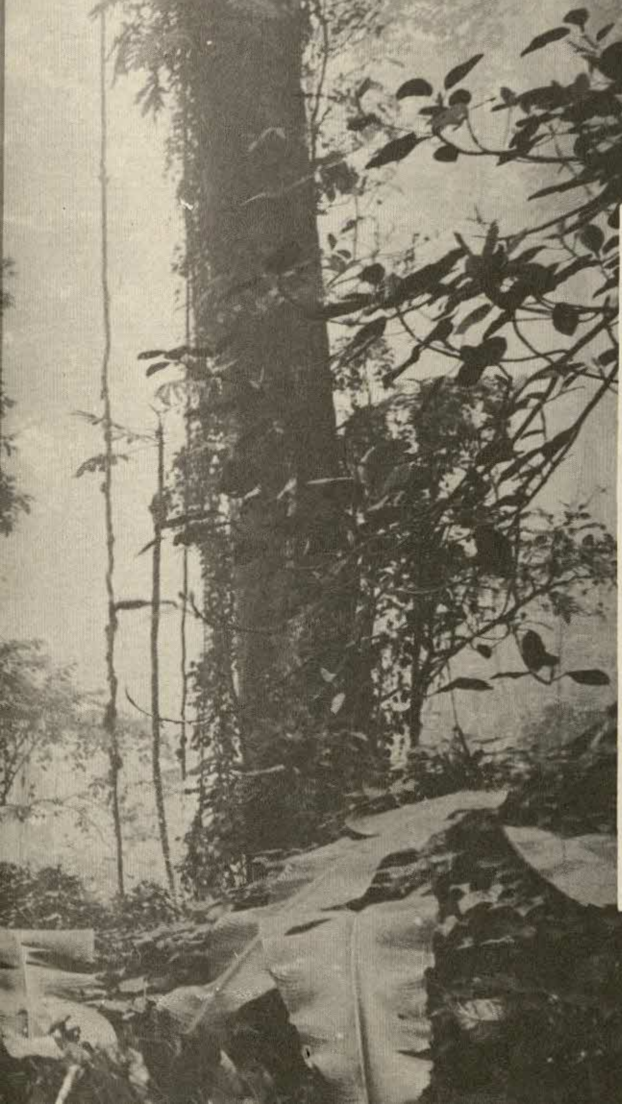
SCOURED OUT BY A GLACIER. Immense northern lakes fill rocky basins which have been scooped out by glaciers, like Lake Superior, left.

A TROPICAL RAIN FOREST, below. Moist climate and tropical heat nourish a tangle of growth that resists man's efforts to tame it.

Konrad Koch

Navy Department

A DESERT OF ICE. Little sunlight reaches the land and water surfaces around the earth's poles. Perpetual cold reigns.



Standard Oil Co. (N.J.)

THE DUNES OF THE DESERT. There are some rainless places where the only water is deep underground. These are deserts, where nothing grows except prickly plants.

Weyerhaeuser Timber Co.

A TEMPERATE RAIN FOREST, left. These tall, straight trees provide us with valuable lumber. Their enemies are fire, wind, insects, and disease.

A FUTURE COAL FIELD, below. Coal is the decayed and compressed plant life of swamps that existed millions of years ago. Today's swamps, like this one, make farming impossible, but provide protection for wild life.

U.S.D.A., Forsythe

winds. The southern part of California, for example, enjoys the protective influence of the mountains against extremes of desert weather, and is favored by rainfall "squeezed" out of the air from the Pacific Ocean as it cools on expanding, while passing up and over the mountains.

Mountain regions are noted for their exhilarating effects. These are due largely to lower pressure, drier, purer air, and intense sunshine. In the winter because the cold air is heavier and drains down the sides of the mountains, the temperatures are colder in the valleys than on the mountain tops; this condition is called *inversion of temperature.* Rainfall increases with altitude up to a certain point, beyond which, owing to the loss of water vapor, it decreases. The zone of greatest rainfall is, on the average, 5000 to 7000 feet in altitude. Mountains usually have a wet side and a dry side, the wet one being toward the ocean or lake from which moisture is obtained. Mountains have high wind velocities, and, indeed, cause local winds and mountain and valley breezes, which largely control the hourly distribution of cloudiness and rainfall of a mountain. The effect of low pressure and dry air is often harmful if a high altitude is reached too quickly.

For further information, consult the following articles:

Acclimatization
Atmosphere
Calms, Regions of
Cloud
Desert
Fog, or Mist
Frost
Gulf Stream
Hail
Humidity
Kuroshio
Latitude
Longitude
Ocean Currents
Rain
Seasons
Snow
Tropics
Troposphere
Weather Bureau
Wind
Zone

CLINTON, DeWitt (1769-1828) Across the rich state of New York extends the Erie Canal, connecting the Great Lakes with the Hudson River. This valuable waterway, still used in shipping a vast amount of goods to and from the Middle West, was constructed largely through the efforts of DeWitt Clinton, the state's most famed governor in the early 1800's.

Born in Little Britain, N. Y., Clinton took up the study of law and was admitted to the bar in 1790. He began his political career as secretary to his uncle, George Clinton, the first governor of New York. In 1797 he was elected to the state legislature. In 1802 he was elected to the United States Senate. He resigned in 1803, however, when he became mayor of New York City. He served in this capacity for ten of the ensuing twelve years. During two of the twelve years, he was a member of the state senate and lieutenant-governor of the state. As mayor of New York City, he did much to further public education, city planning, city fortifications, and sanitation, and aid to the poor. He opposed James Madison for the Presidency in 1812, but was defeated.

In 1810 he became a member of the Erie Canal Commission, and seven years later was elected governor of the state on a platform favoring the construction of the waterway. The work was begun in Clinton's administration, and until 1823 he devoted himself largely to completing the canal. During these six years, however, he was opposed by Martin Van Buren and Tammany Hall, and he refused to seek a third term in the election of 1822. Two years later, his opponents even removed him from the Canal Commission, but this action so infuriated the people of the state that he was again elected governor in 1825.

That year saw the realization of his great dream, the completion of the canal. It was he who inaugurated it by pouring water from Lake Erie into the New York Harbor, symbolizing the union of east and west. He died three years later, still governor of the state. See ERIE CANAL; NEW YORK STATE BARGE CANAL.

CLIVE, ROBERT, Baron of Plassey (1725-1774). India, fabulously rich treasure chest of the East, was British for centuries because of Robert Clive, an unruly schoolboy who grew up to be one of England's greatest empire builders. A clerk who became a brilliant soldier with no military training, a statesman with no experience in the traditions of European diplomacy, he united the most important provinces of India and brought them under British rule.

In his native Shropshire, in England, Clive was a difficult pupil. He would not study; he was always getting into trouble; his teachers and his parents tried in vain to curb his adventurous spirit. When he was eighteen, Clive went to Madras on the southeast coast of India, where he was employed as a "writer" for the East India Company. There, he continued his troublous career, and his scrapes brought censure from his superiors. He did, however, study in India and learned much that was to help him later in life.

In 1746, when war broke out between the French and English in India, Madras was captured, and young Clive fled with other Englishmen to Fort Saint David. He joined the army and immediately won recognition as a commander, but it was not until the Battle of Arcot in 1751 that he became famous. In that battle he seized the city from the French and natives and defended it brilliantly with only a small force of men. His star rose in the next two years, but because of his health he returned to England in 1753. Three years later he returned to be governor of Fort Saint David. The very day he took office, Calcutta was captured by the nawab ruler of Bengal, and the "Black Hole" tragedy occurred.

Clive set out to avenge the British. In February, 1757, he defeated Suraj-ud-Dowlah, the nawab, in a battle near Calcutta with a force outnumbered nearly thirty to one. But the nawab, stirred by the French, still opposed the British, and Clive determined to punish him. On June 21, Clive, with a force of 3,200, was at Plassey, north of Calcutta. The nawab had a force of more than 65,000. Clive at first decided to wait; then, suddenly, he made up his mind to attack. The battle occurred June 23. The nawab was defeated, and the British at last were in control of the province of Bengal. Jafar Ali, one of the defeated nawab's generals, was placed on the throne by Clive. In return, Clive was rewarded with considerable wealth.

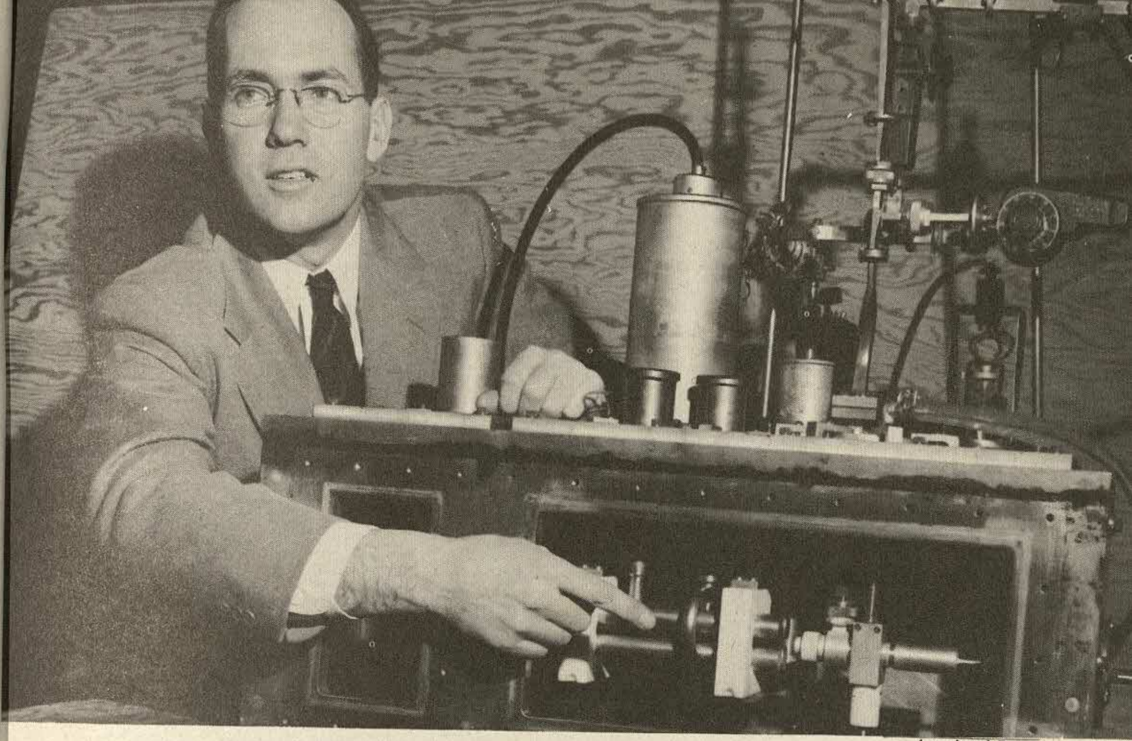
In 1760 he returned to England, where he was made Baron Clive of Plassey and elected to the House of Commons. But in 1765 he went back to Calcutta, where he put down insurrections, obtained for the East India Company direct control over the provinces of Bengal, Bihar, and Orissa, and, as governor, became the ruler of 30,000,000 people.

Clive, suffering from an incurable disease, was bitterly opposed by his enemies when he returned to England again. His acquisition of wealth and his agreements and treaties with the Indian princes were investigated by the House of Commons. But the findings in 1773 were a compromise which recognized the great service he had done his country.

Clive was never again to see the empire he had created for England. His failing health and the charges against him broke his spirit. In 1774 he committed suicide.

AN ENGLISH CLERK WHO KNEW NO FEAR

Clive of India rose from a lowly post as counting-house clerk to fame as an empire builder. Here he faces down an enemy who has threatened to shoot him but dares not.



Associated Press

ATOMIC CLOCK — CHAMPION TIMEKEEPER

This clock developed at Columbia University uses energy radiated by molecules of ammonia gas. It is more accurate than timepieces based on the earth's rotation.

CLOCK. Man has invented many ways to tell time, but none of them is as effective as the clock, a device that tells us the hour, minute, and even the seconds at any time during the day or night. The name comes from French and German words meaning *bell,* since many of the early clocks of these countries told time by the ringing of bells.

There is hardly a place in civilized countries where the clock is not needed. It tells us when we must be at school and at work; when we should eat and when we should sleep; in fact, it governs our entire day. Running schedules of railroad trains, ships, and airliners are arranged according to the clock, and the opening and closing hours of all business establishments are based upon this same useful device.

What Makes the Clock Run. Modern clocks consist of a weight or spring that supplies the power to move a system of wheels. One of these wheels makes a complete revolution every twelve hours. This wheel moves the hour hand. Another wheel makes a complete revolution every hour. This moves the minute hand. Still another wheel, if there is one, moves the second hand. The movement of these wheels is controlled by a *pendulum,* or *balance wheel,* which is attached to the *escapement.* The escapement consists of two prongs which hang over a toothed wheel, connected by cogs to the wheels which revolve and register the time. As the pendulum swings, one prong is released from the toothed wheel and another fits in, acting as a regulator on the motion of the wheels. When we wind a clock we either raise weights so that they can descend and set the wheels in motion, or we tighten a spring that acts the same way.

The chimes on a clock are worked by a separate mechanism which is set in motion by a lever on the clock wheels. Sometimes, instead of chimes, there is a mechanism which operates a mechanical bird to call the hours. This type is the well-known cuckoo clock. The hands of a clock should always be moved forward when the timepiece is being set, because the natural movement of the clock is forward, and to move them backward might disarrange the mechanism, especially the chimes.

When a clock runs slow, it means that the pendulum, or balance wheel, is swinging too slowly. This fault may be adjusted by shortening the pendulum or the wheel. When the timepiece is running fast, the pendulum arm or wheel should be lengthened.

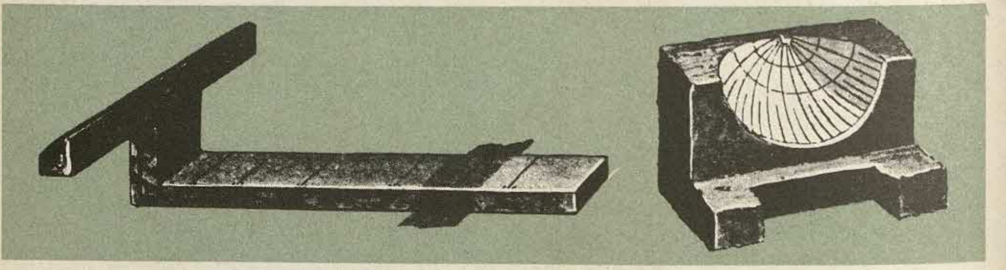
Clocks Through the Ages. Man started to tell time long before history began. Of course, these early methods were not accurate, for time then was usually reckoned according to the sun's shadow; and at night, or when the sun did not shine, one could not tell the time. The earliest form of clock was the *sun dial,* used by the Egyptians. The Greeks improved upon this form of timepiece by making the dial semicircular, as did the Romans. The sun dial works according to the revolution of the earth. As the earth moves, the shadow of a pointer on the dial moves across numbers corresponding to the hours of the day. Sun dials are still in use, but as lawn and garden ornaments rather than practical timepieces.

Another ancient instrument is the *water clock,* a timepiece that measures time by the flow of water. About 4,000 B. C., the Chinese found a way to tell time at night by using two vessels. They poured water into a container, from which it ran down into a lower one. But when they found that the water did not run at a regular rate, they added more vessels. This clock was "wound" by emptying the lowest vessel into the top one every twenty-four hours, for it took that long for the water to flow through the series of containers.

In some countries, a funnel-shaped vessel was used for the top container. A float with a stick at the top was in the upper vessel. As the water ran into the lower vessel, the float sank and the hours were indicated by the stick that sank with the float. But this was not satisfactory. About 140 B. C., Ctesibius of Alexandria improved on this form of clock by filling a vessel with a continual flow of water. A toothed rod was attached to a float, and as it rose, its teeth fitted into a gear which rotated a hand on a dial. There was only one hand and it made a complete revolution once a day.

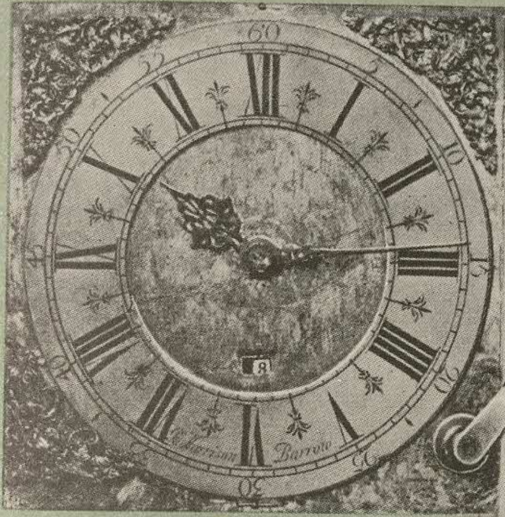
Another early clock was the *sand clock,* or *hour glass.* It consisted of two containers connected by a narrow neck. One container was filled with sand which dropped slowly into the lower one. When all the sand had dripped through, an hour or two hours had gone by, and the device was turned upside down. The operation would then be repeated.

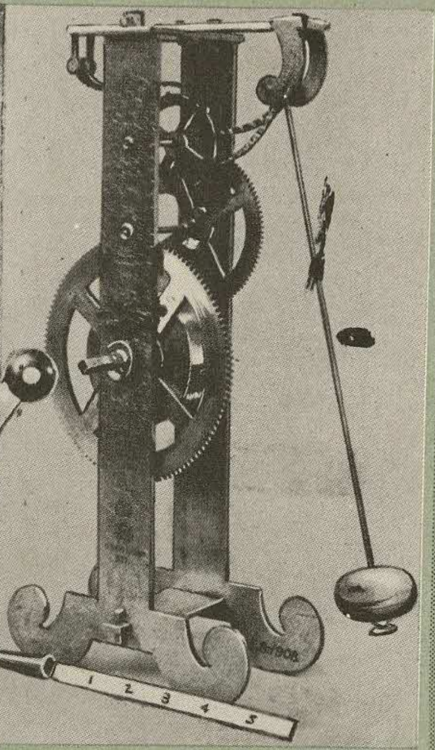
The *fire clock* was used many years ago. This consisted of a rope with knots tied in it at regular intervals. The end of the rope was set on fire, and as it reached the knots, it meant the passage of a certain length of time. *Oil lamps* and *candle clocks* also were used, the hours being measured by the length of time it took for the flame to burn the oil in a container, or the length of a candle. King Alfred the Great of England

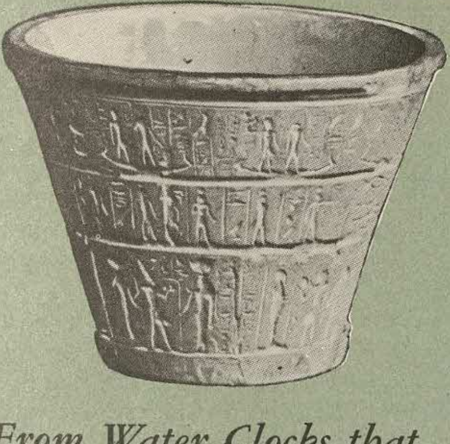


PROGRESSING TOWARD THE MODERN CLOCK

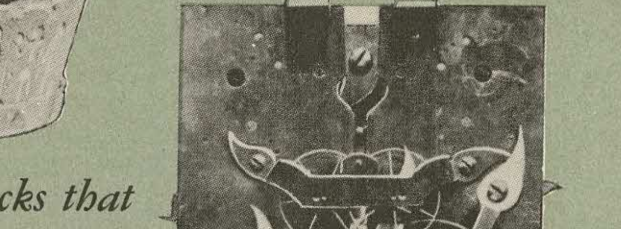
Throughout the ages the question "What time is it?" has fascinated men. Ages ago it was answered with shadow clocks. Left, an Egyptian type. Right, an early Greek "scooped" sun dial.







From Water Clocks that Drip ~ *to Pendulums that* Tick



Clocks have had a long history reaching back to early Egypt. Upper left, an eight-day clock with wooden works (1715); a hole in the dial shows the day of the month. Upper right, a model of Galileo's escapement, showing use of pendulum to control clock. Right, an anti-friction clock made for King George III of England. Above, a water clock which kept time 3,500 years ago.

had candle clocks, and to prevent them from being disturbed by the air or wind, he covered them. These coverings were called *lanthorns.* The word later was shortened, giving us our present name for the lantern.

The first modern clock of which we have a full description was made in 1364 by Henry De Vick for King Charles V of France. It was a large tower clock driven by a falling weight. It had only an hour hand. Clocks did not have minute hands for another three hundred years. Spring-driven clocks appeared after Peter Henlein of Nuremburg, Germany, invented the mainspring, about 1500. Christian Huygens, a Dutch scientist, is credited with making the first pendulum clock, in 1657. Eli Terry (1772-1852), a Connecticut clockmaker, is said to have been first to use machinery and interchangeable parts in making clocks.

Common electric clocks operate similarly to other kinds except that they are driven by electric motors. Quartz crystals are used to regulate the flow of electric current in highly accurate clocks used for scientific purposes. Under proper conditions, quartz crystals vibrate a certain number of times a second with very little variation when an electric current is passed through them. Some quartz crystal clocks are accurate to within one one-thousandth of a second a day.

Atomic clocks depend for their operation on the fact that molecules vibrate at a fixed rate, depending on the vibrations of their atoms. In one type, the vibrations of ammonia gas molecules are used to check and adjust the vibrations of quartz crystals. In another, the ammonia gas molecules are made to produce radio waves with a frequency of 24,000,000,000 cycles a second. These highly precise radio waves are amplified and used to measure time. It would take more than three hundred years for this clock to gain or lose one second.

Famous Clocks. The clock of the Strasbourg Cathedral, France, is remarkably elaborate. Its three dials tell not only the time but also the days of the week and month and the position of the planets. When the old year dies, the days of the week adjust themselves. February 29 takes its place in leap years; and Easter and other holidays with varying dates arrange themselves in correct order. Each quarter hour a bell is struck and at noon, the twelve apostles pass before Christ.

Other ingenious mechanical clocks are found in Munich, Prague, and other European cities.

Big Ben is the name of the largest bell in the clock on Westminster Tower, London, but the clock is also known by that name. It has four faces, and the minute hands are fourteen feet long. Every New Year's eve, Big Ben is heard around the world by radio. See ELECTRIC CLOCK; WATCH.

CLOTH. In the old days, cloth did not have its present meaning of a piece of woven goods. The word is from an old Anglo-Saxon word meaning *garment.* No primitive people ever wove textiles in pieces or bolts of many yards in length with the intention of later cutting them up to make garments or other articles. All cloth was made of the size and shape to serve the particular purpose for which it was designed. Examples of such complete weavings are seen in rugs, in the *poncho* and *serape* (blanket cloaks) of the native of Mexico and southward, and in the blanket of the American Indian.

Present-day woven articles of more developed peoples are woven almost exclusively by the yard and handled in trade as piece goods, as yards of carpet, satin, or muslin. Rugs and tapestries are exceptions, but otherwise almost all examples of weaving before coming into actual use must be cut and shaped, fitted and sewed, in order to be of service.

If we look carefully at a piece of plain cloth which is still as wide as it was when woven, we find it to consist, first, of a number of threads placed side by side and running the long way of the cloth. Second, these threads are crossed by a single continuous thread which passes alternately over and under those running the long way, and interlaces them to form a flat and orderly material. The threads thus woven are more or less firm and durable according to their strength and evenness and the closeness with which the folds of the crossing thread have been pressed together.

The threads running the long way of the cloth are always called the *warp*. In order to allow of their being conveniently intersected by the continuous crossing thread, they have to be tightly stretched in their position on some kind of a frame prepared for the purpose. The continuous crossing thread has been called by several names, but the oldest and most common are *weft* and *woof*.

In almost all kinds of cloth, the warp threads are much finer than the weft thread, and differ not only in size but in the way in which they are prepared for use. The warp threads need to be hard, firm, and much twisted. The weft thread is only slightly twisted, except in a few very special kinds of cloth. This character makes it soft and yielding, enabling the weaver to press each to-and-fro fold of the weft well down against the last fold and thus to beat both the warp and weft together into a firm, good material. Different kinds of cloth are produced by the use of threads of different materials, of different size and twist, and by different methods of interlacing the warp and weft. See TEXTILES; WEAVING.

CLOTHES MOTH. There are three species of clothes moths that are annoying household pests. All three are natives of Europe, but for many years have been present in America. The *case-making* clothes moth is the most generally distributed of the three, and is the common one in the Central and Northeastern states and throughout Canada. The *webbing* clothes moth is found in the North and in Canada, but is most common in the South. The third one, the *tapestry* clothes moth, is not so common as the other two species.

The two common forms are very small, yellowish-white moths with faint dark markings. The tapestry moth is larger, spreading about three-fourths of an inch. It is more striking in color. The two common species seek dark, undisturbed places and lay their eggs on woolens, furs, and feathers. The tapestry clothes moth seems to prefer heavier and coarser cloths.

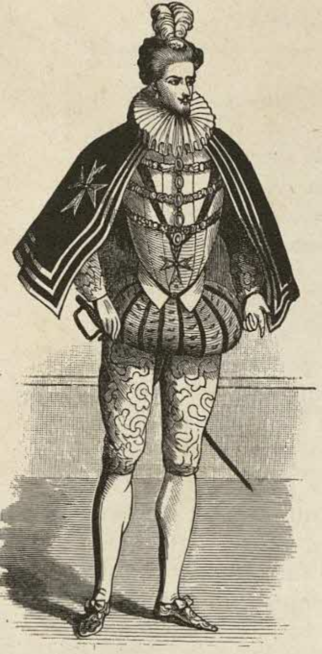
The larva of the case-making clothes moth makes a small tubelike case of the material upon which it is feeding. On reaching maturity it pupates in this tube. The larva of the webbing clothes moth does not form a case, but spins a web of silk where it feeds or moves about. When ready to pupate, it forms a cocoon of silk and the particles of food on which it has been feeding. The larva of the tapestry clothes moth tunnels in the food, lining the galleries with silk. It pupates in one of the galleries, or tubes.

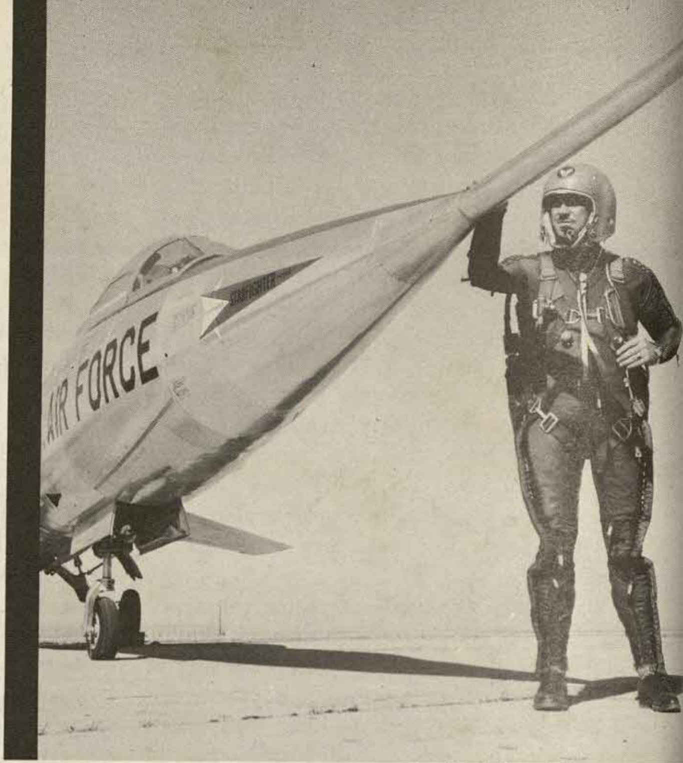
Prevention is a very practical method of controlling moths. Woolens, furs, and other garments which moths feed upon should be cleaned and aired before being stored away, and should then be wrapped in heavy paper or placed in moth-proof bags. Closets can be kept free of the pests by means of fumigation at regular intervals. Anti-moth crystals which vaporize in an attachment to a vacuum cleaner are on the market and available to the housewife.

CLOTHING. Any garment or other article of dress that covers all or part of the body is clothing. It may be fur, hide, or woven material; it may range from a shawl or sheet to a hat or elaborate lace gown. But, regardless of its texture, clothing is exceeded only by food and shelter in importance to man.

Clothing probably was first worn by man as ornament to display his prowess as a hunter and fighter. Later he wore furs and hides for protection against the cold; and, still later, he wore clothing because of a sense of modesty. The first clothes were very primitive, consisting of the skin of an animal. As man progressed, he learned to weave cloth for his clothing and to develop different styles.

The fascinating story of *dress* is told in the article under that heading.





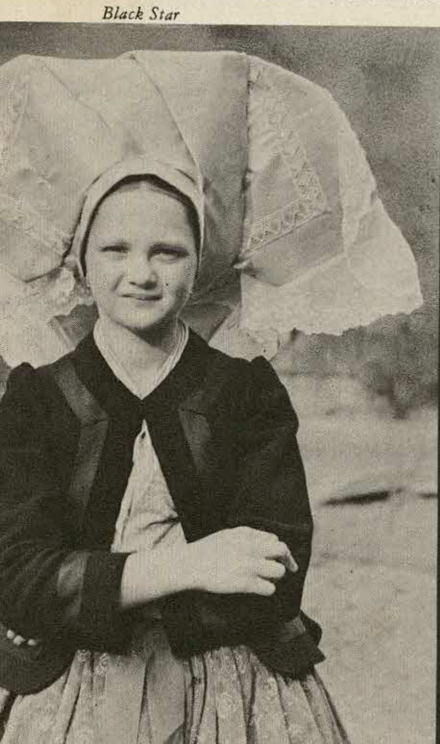
Lockheed Aircraft Co.

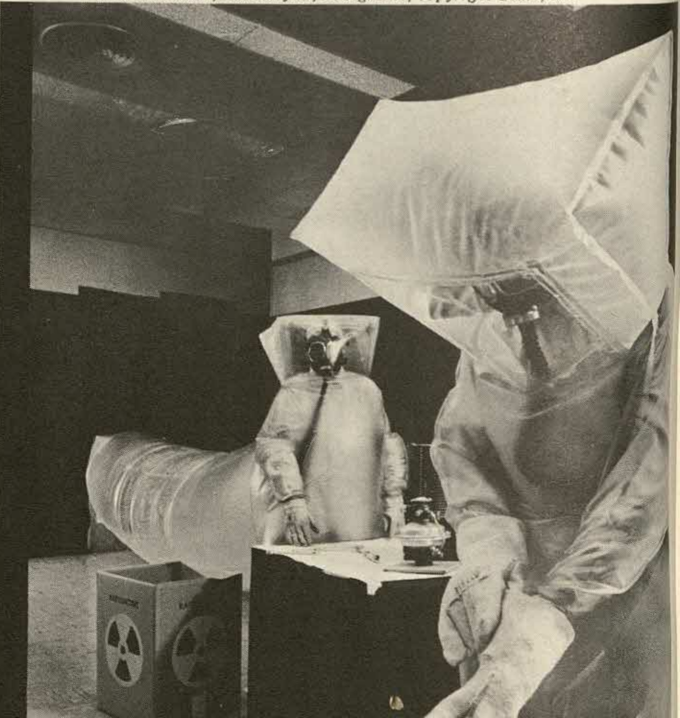
HOW CLOTHING HAS CHANGED—OR HAS IT?

There is sometimes a surprising resemblance between atomic age and medieval garments. King Henry III of France, above left, in his tight-corseted court dress looks curiously like the jet pilot at right in his pressurized flight suit. Below left, a traditional Wendish headdress of eastern Germany appears to be the model for the pillowlike hoods, right, which protect atomic workers from radioactive dust. Worker enters plastic suit through 15-foot hollow tail.

Black Star

N. R. Farbman, Courtesy Life Magazine, copyright Time, Inc.





Santa Fe Railway Photograph

Nature's Beautiful Barometers

CLOUD. The designs and motions of clouds are among the inspiring sights of nature. Out of the west ride the long bands of cirrus, running in advance of a storm. Rushing across the sky go the gale-driven nimbus clouds sprinkling the earth with rain. Sometimes slowly, sometimes rapidly, the brilliant, knobby cumulus clouds march with their cooling showers. We may look up at the sky and imagine we see white castles or a flock of fluffy lambs. The clouds at sunset present a brilliant array of red, orange, and purple and, as a storm approaches, a display of black and white.

It seems strange that such things as clouds, ever-changing and always moving, should be merely visible drops of water or snowflakes in the air. But that is what they are—visible masses of water formed by the condensation of moisture in the atmosphere. *Convection currents,* or waves of heat, cause clouds to assume many different shapes and forms. For instance, the large, fluffy clouds that may look like castles in the air are caused by convection currents rising from the ground. Those clouds which resemble sheets and bands are caused by the cooling of the heat currents as they rise. The fluffy, woolly clouds are the result of both cooling caused by rising currents, and convection.

Names for Clouds. All these cloud designs have different names, and knowing them enables a person to spend many fascinating hours out in the open. The knowledge is also helpful in forecasting the weather. There are four distinct types of clouds, cirrus, cumulus, stratus, and nimbus, which may be divided into ten standard forms.

Cirrus clouds are delicate and wispy, sometimes resembling the tail of a horse. They are generally of whitish color and may appear to converge at a certain point on the horizon. These clouds are usually from three to seven miles high and are composed of ice particles.

Cirro-stratus clouds are thin and whitish and sometimes completely cover the sky. They may make the sky appear milky or like a tangled web. They range from three to seven miles in height and often produce halos around the sun and moon.

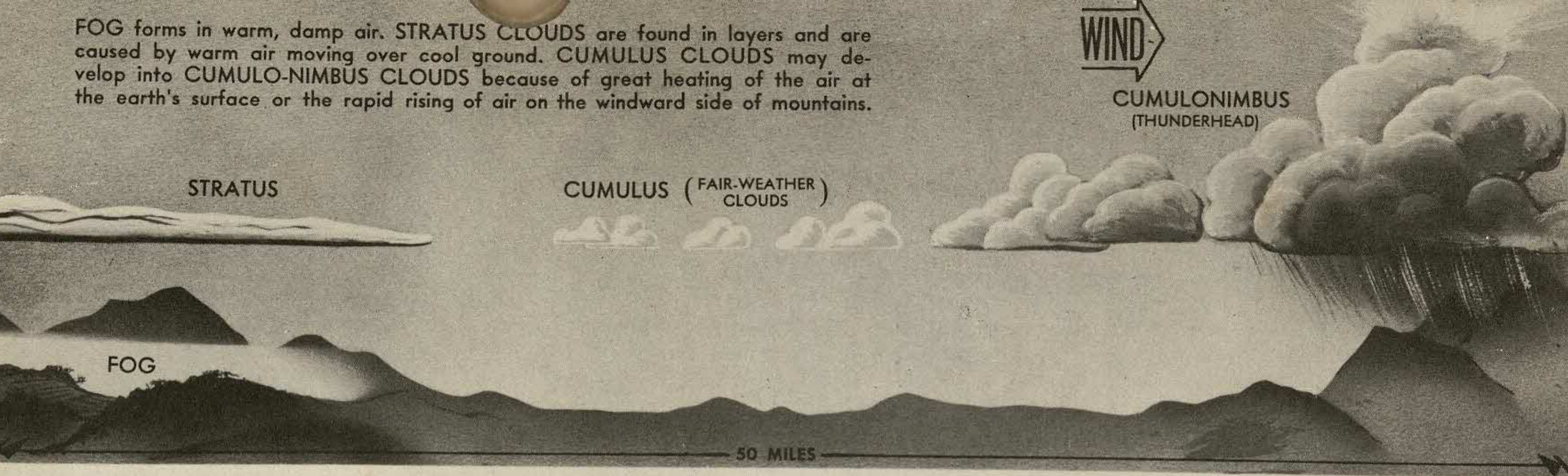
Cirro-cumulus clouds cause a "mackerel sky" with small, globular, white masses arranged in groups and lines. They are from three to seven miles high.

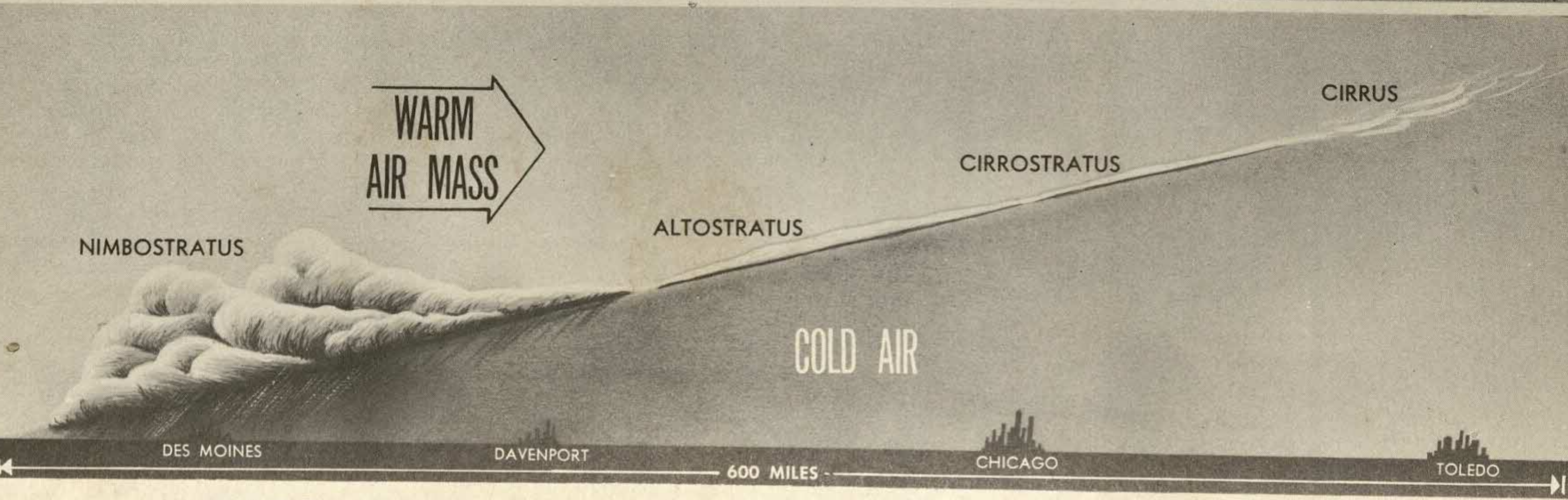
Alto-stratus clouds form a thick sheet of gray or bluish color. They have the appearance of ground glass when the sun or moon shine through them. Actually they are clouds of snow, but not quite so high as the cirrus clouds.

Alto-cumulus clouds are large, globular masses which sometimes spread out like small plates in the heavens. They are from one to three miles in height.

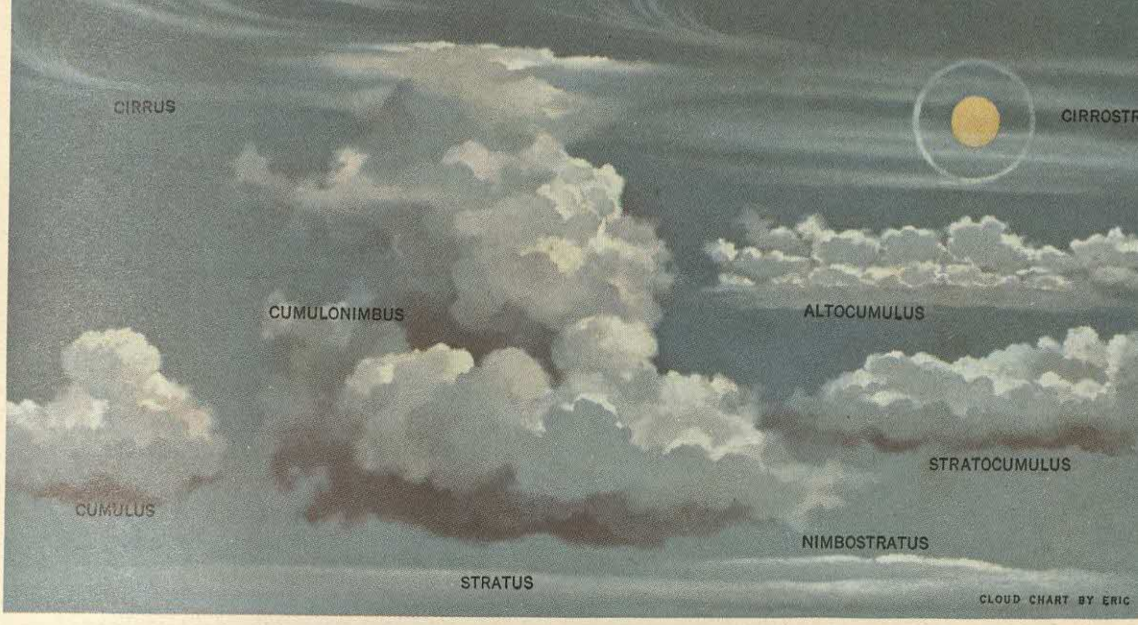
Strato-cumulus clouds may take the form of large globular masses or dark rolls which

FOG forms in warm, damp air. STRATUS CLOUDS are found in layers and are caused by warm air moving over cool ground. CUMULUS CLOUDS may develop into CUMULO-NIMBUS CLOUDS because of great heating of the air at the earth's surface or the rapid rising of air on the windward side of mountains.





WARM FRONT . . . As the warm air mass moves forward, it slides up the slope of the cold air mass. When the warm air is lifted, its temperature is lowered, causing condensation and rain. As the air moves farther up the slope, the clouds flatten into ALTO-STRATUS and CIRRO-STRATUS clouds, and finally into windblown CIRRUS clouds in the high altitudes.



Boeing Airplane Company; Hardware Mutuals

SUSPENSION IN THE AIR

Clouds are suspensions of water in the air. Different kinds of clouds form at different levels. Above, the high clouds, cirrus and cirrostratus, float above 20,000 feet. Altocumulus are the middle clouds, always above 6,500 feet. Stratocumulus, stratus, and nimbostratus are the low clouds below 6,500 feet. Cumulus and cumulonimbus have a special vertical formation with the base not below 1,600 feet. With the possible exception of the cirrus and cumulus, cloud formations are a sign of rain or snow. The low clouds produce the steady precipitation, and the vertical clouds cause the squalls. The cloud pictured below is the funnel-shaped tornado, which dangles like a giant suction hose. Each time it touches the ground, it sucks up dirt and debris, and twists to shambles any structure not strong enough to resist its fury.

cover the whole sky. At night, with the moon shining through the open spaces, they are a beautiful sight. They are not rain clouds and range up to two miles in height.

Cumulus clouds are the great white, fleecy masses often seen in spring and summer. The bottoms appear flat and black, but the tops, when facing the sun, shine with a white brilliance. They may be as high as two miles above the ground.

Cumulo-nimbus clouds are the black, lowering thunderclouds. They rise in the form of mountains, turrets, or anvils. Local showers of rain or hail fall from their bases. These clouds may appear at ground level or as high as two miles.

Nimbus clouds are the real rain clouds. They are thick and shapeless with ragged edges. When they appear, steady rain or snow falls.

Stratus clouds form a uniform layer resembling a fog, but not resting upon the ground. They are usually less than a mile high, like nimbus.

Telling the Weather by Clouds. The speed and direction of clouds is determined by the speed and direction of the wind. Thus, by observing these factors of clouds, it is possible to determine the pressure changes of the air and the shifting of the wind. White cumulus clouds, small and fleecy, usually indicate fair weather. Cirrus clouds indicate an approaching storm, usually within two days.

In aviation the study of clouds is important. Clouds determine the "ceiling" for flyers. When they are low, the "ceiling" is low; and, when there are many clouds, caution must be used because they obstruct visibility. Sometimes airplanes fly above the clouds to escape a storm.

Cloudbursts. Actually, there is no such thing as a cloudburst. It is the name given to a very heavy, sudden rain. A cloudburst is usually confined to a small area. See CONDENSATION; RAIN; STORMS.

CLO'VER. Combining beauty with usefulness, clover is a valued crop for hay, pasturage, and soil enrichment. Not only does this member of the pea family yield an excellent food for horses and cattle, but it builds up the fertility of the soil as well. When it is in full bloom, it is a veritable treasure chest of nectar for bees.

Clover will grow almost anywhere if there are bumblebees, which are necessary in its fertilization. Of the more than 300 species, the best known are *red* clover, which lives for two, and sometimes three, years; *white* clover, found in Europe and Asia as well as North America; *alsike,* or *Swedish* clover, a particularly hardy species; and the perennial *red,* or *meadow,* clover.

The excellence of clover as a soil-building crop is attributed to the small swellings, or nodules, on its roots, in which bacteria change nitrogen into substances that plants can use, and must have, to build tissues. Because they bear pods like those of the pea, clovers are classified as legumes.

The name clover, in one form or another, is much older than the known agricultural use of these plants, and, in different forms, is common to languages of all the northern European peoples. As early as the year 800, the term *clafre,* or *clabre,* was in use in the Old Saxon tongue, indicating that these plants were known to the peoples of that day.

CLOVES. Fragrant in odor and sharp in taste, the dried buds of the clove tree are a tasty and well-known seasoning for cooking. Useful, too, in medicine is oil of cloves, manufactured from the liquid squeezed from the buds.

Growing in tropical countries, the clove tree is an evergreen which reaches a height of forty feet. It has long, smooth leaves and purplish flowers. The buds are nail-like in appearance, giving rise to their name, which comes from the French word *clou,* meaning *nail.*

Cloves were famed in the Eastern trade before the birth of Christ. They formed part of the fabulous wealth of the East which first tempted Portuguese navigators to round the Cape of Good Hope. For a hundred years the Portuguese controlled the trade. Then the Dutch drove them out and tried to secure a monopoly. They exterminated, or paid native chieftains to kill, the trees in all but one of the Spice Islands, or Moluccas, where they grew. After many years and many attempts, the French succeeded in transplanting some of the trees which had escaped notice. Today the clove is grown in Asia, Africa, South America, the West Indies, and other islands.

CLO'VIS (about 466-511). After becoming king of the Franks at the age of fifteen, Clovis steadily enlarged his kingdom. In 486 he defeated the Roman general Syagrius at Soissons and acquired the territory between the Somme and the Loire rivers. The Frankish kingdom grew under his rule until it included what is now France. In fact, France is named for the Franks.

Although Clovis was a pagan most of his life, he married a Christian. He himself was baptized after a successful battle in which he had prayed to the God of his wife for victory.

CLUB. A group of persons united for the purpose of furthering good-fellowship or promoting welfare, political, or social aims may be known as a club. An outgrowth of a desire possessed by all human beings to meet with one another, the club holds an important place in the social life of boys and girls, men and women.

There are clubs of all types: athletic clubs, organized to sponsor teams in competitions; literary clubs, composed of people interested in literature; bridge clubs for those who like to play cards; golf and country clubs devoted to sports and social affairs; and fraternities and sororities which are secret organizations, although they are social and educational in nature.

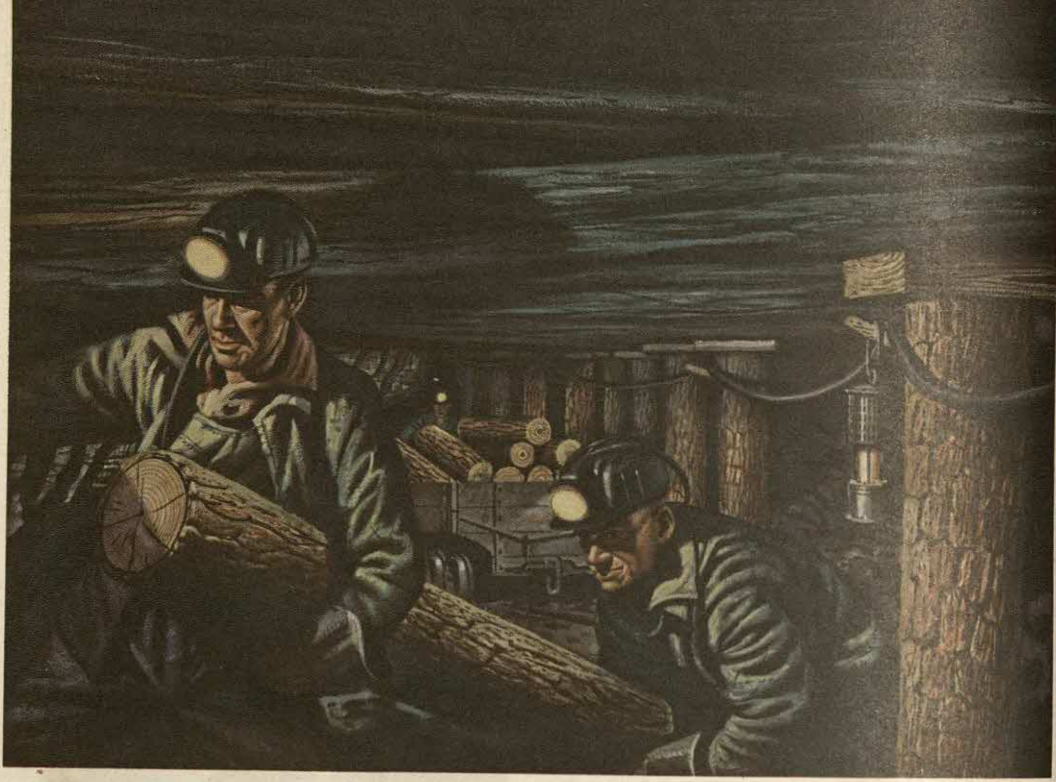
Boys and girls may organize hobby clubs, or secret societies, or athletic clubs, governed by a set of rules and headed by officers. Such organizations often lead to lifetime friendships. In rural districts the 4-H clubs take a leading part in the life of the community; in the cities, neighborhood clubs provide recreation and entertainment.

Clubs had their beginnings long ago. No doubt ancient Greeks and Romans met together in organizations that were very much like our modern clubs. During the seventeenth and eighteenth centuries, the coffeehouses and taverns provided meeting places for individuals and probably were the forerunners of our modern clubs.

THE CONVERSION OF A GREAT KING
Clovis, ruler of the Franks, became a Roman Catholic and was baptized in 496.

Today many clubs maintain elaborate buildings where the members may meet, dine, and enjoy social activities. Some of them have gymnasiums, swimming pools, pool and billiard rooms, bowling alleys, ballrooms, reading rooms, sleeping quarters, and many other facilities for comfort and enjoyment. Many clubs sponsor exhibits, shows, and entertainments, contribute funds to charity, aid unfortunate families and children, take an active part in politics and government, and in other ways enter into the affairs of the community.

See Boys' and Girls' 4-H Clubs; Boy Scouts; Camp Fire Girls; Girl Scouts.



Travelers Insurance Company

"GROANERS" WARN COAL MINERS

Mine timbers made of loblolly pine make a groaning sound when too much weight is placed on them. Their groans tell the miners where additional timbers are needed for safety.

COAL. Only the minerals essential to life are more valuable to man than coal. Coal provides about two-thirds of the world's mechanical and electrical energy, though it has been exceeded by petroleum as a source of energy in the United States. It heats many homes and other buildings, supplies ships and factories with energy, and furnishes much of our electrical power. Iron and steel would be comparatively rare except for coal because coke made from coal is used to smelt ore. Coal is also a rich source from which chemists obtain thousands of products ranging from delicate perfumes to explosives. Chemically, coal is a combination of carbon, hydrogen, oxygen, nitrogen, and various minerals.

Origin and Varieties

Buried Sunlight. Coal is literally buried sunlight. When we burn coal we are releasing the energy that plants have captured from the sun and changed into solid substances. The formation of coal began when the first land plants started to grow, and it still goes on in swamps all over the world. Dead swamp plants become partly decayed into peat. When peat has been buried long enough and deeply enough it becomes coal.

The Pennsylvanian Period. Coal was formed most rapidly during the Pennsylvanian Period, which lasted for 30,000,000 years and ended about 250,000,000 years ago. During this period, large areas of the earth were covered by steamy tropical swamps in which fantastic plants grew in lush profusion. Among these strange plants, there was not a single flower, for plants had not yet "learned" to grow flowers. But there were club mosses and horsetail rushes fifty to a hundred feet tall, the ancestors of plants that now grow only a few inches high. Ferns, too, grew as large as trees. We know what kinds of plants grew at that time because fossilized molds of them are found in the rocks in coal mines. Sometimes fossilized tree trunks and other plant parts are found in mines.

Generation after generation, the plants grew, died, and fell into the soft muck. They eventually turned into peaty masses that were sometimes hundreds of feet deep. The period was one of violent earth convulsions. At times the earth sank under a swamp and rivers or the sea washed a thick layer of mud or sand over it. With the passage of time, deposits of mud, sand, or lime would form another swamp, or another upheaval would raise the land and more generations of plants would become peat. The process was repeated time and again. In some mines, the remains of more than a hundred ancient swamps have been found, layered one above the other and separated by bands of rock. Some coal seams are only a few inches thick, others are several feet thick. The largest known, in Manchuria, is 400 feet thick.

Swamps Become Black Diamonds. With the increasing pressure of the overlying earth, the mud turned to shale, the sand to sandstone, and the lime to limestone. Water was squeezed out of the peat. Part of the oxygen and hydrogen in the peat passed off as gas. The carbon content of the peat increased as the gases escaped, and the peat became a soft brown coal called lignite. As the pressure grew greater and more gases escaped and the carbon content increased, the lignite became bituminous coal, or soft coal. In places, the earth heaved and writhed and buckled and folded. The tremendous pressure placed on the bituminous coal changed it to hard coal, or anthracite.

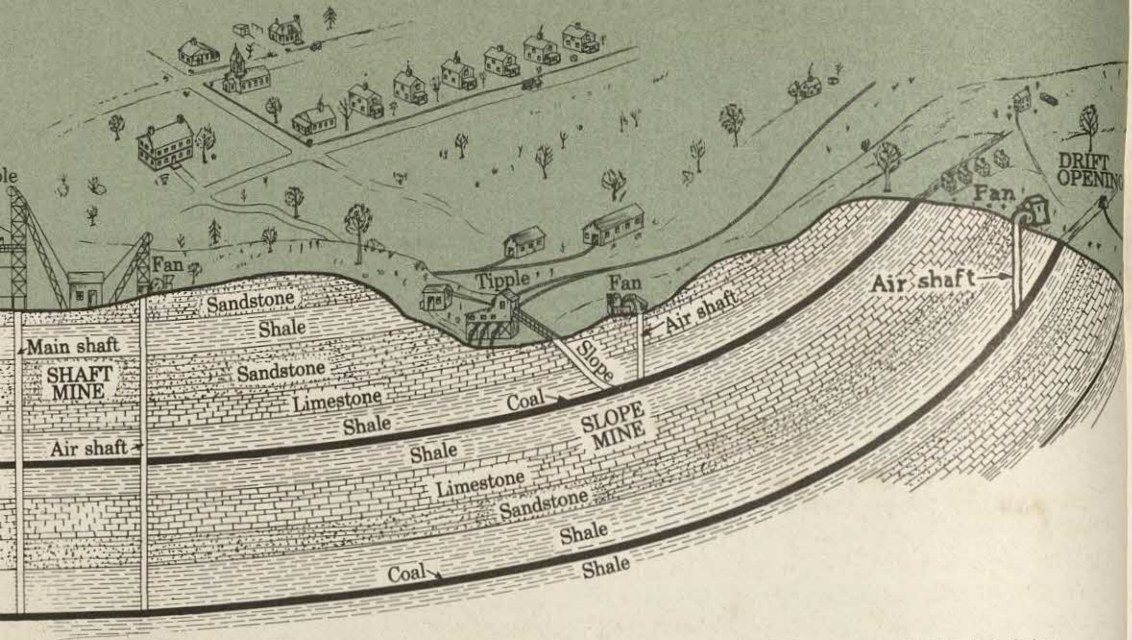
Kinds of Coal. *Lignite* is a soft brown coal that contains a good deal of moisture and comparatively little carbon. It gives only half as much heat as the best grades of bituminous coal.

Bituminous coal, or soft coal, is the kind that is most widely used. It is a black coal that breaks into blocks. The best kinds contain more than 80 per cent carbon and only from 3 to 5 per cent moisture.

Subbituminous coal ranks between lignite and bituminous coal in its properties.

THESE WEIRD PLANTS PROVIDED US WITH COAL

Great marsh trees and prehistoric mosses flourished in the *carboniferous* age, or "coal producing" period, millions of years ago. When this vegetation died, it settled into peat bogs, and slowly sank deeper and deeper until it was buried under huge masses of rock. Pressure and chemical changes turned the plants into beds of coal beneath the surface.



THREE KINDS OF COAL MINES *National Coal Assn.*

A shaft mine, a slope mine, and a drift mine are shown here. The kind of mine used depends on the location of the coal. Where it can be reached by tunneling into a hill, a drift opening is used. In the shallow slope mine, the coal is reached by a ramp. A shaft mine is used where the coal lies deep under the ground.

Anthracite is a hard, black, shiny coal that does not dirty the hands when touched. Some kinds are so hard that they can be carved. Anthracite breaks into pieces shaped like oyster shells. It contains more than 90 per cent carbon and 3 per cent moisture.

Cannel coal is a hard bright black coal that breaks much as anthracite does. Its name, a corruption of candle coal, was given to it because it burns with a bright yellow flame like a candle. It is used in open fireplaces. A remarkable thing about this kind of coal is that it is made up mainly of the spores and spore cases of prehistoric plants.

Distribution and Production

Where Coal is Found. Coal is found on all continents, even in Antarctica, but the United States has by far the greatest known deposits. The world's coal reserves are estimated at about 6.3 trillion tons. The United States is believed to have about 2.9 trillion tons, the Soviet Union 1.2 trillion tons, China 1.1 trillion tons, Germany 337 billion tons, Africa 206 billion tons, the United Kingdom 172 billion tons, Poland 98 billion tons, Canada 89 billion tons, Australia and New Zealand 54 billion tons, South America 3 billion tons.

The coal reserves of the United States lie chiefly in three areas. In the east, the Appalachian field covers about 70,000 square miles. It includes the anthracite beds that cover about 480 square miles in eastern Pennsylvania and the bituminous deposits in western Pennsylvania, Ohio, Maryland, West Virginia, Virginia, eastern Kentucky, Tennessee, Georgia, and Alabama.

Another great bituminous field exists in Illinois, Indiana, western Kentucky, Michigan, Iowa, Missouri, Oklahoma, Kansas, Arkansas, and Texas. The third area lies in the Dakotas, Wyoming, Montana, Utah, Colorado, and New Mexico. It consists chiefly of lignite and subbituminous coal.

Coal Production. The world annually mines from 1.8 to 2.1 billion tons of coal. The United States produces more than one fourth of this. Germany produces about one fifth. The Soviet Union is believed to produce more than 300 million tons yearly. The United Kingdom mines 250 million tons a year.

More than one fourth of the coal mined

in the United States is produced in West Virginia, and almost one fourth comes from Pennsylvania. Next, in order of production, rank Kentucky, Illinois, Ohio, Virginia, Indiana, Alabama, Utah, Wyoming, Tennessee, and Colorado. Coal is mined in thirty states.

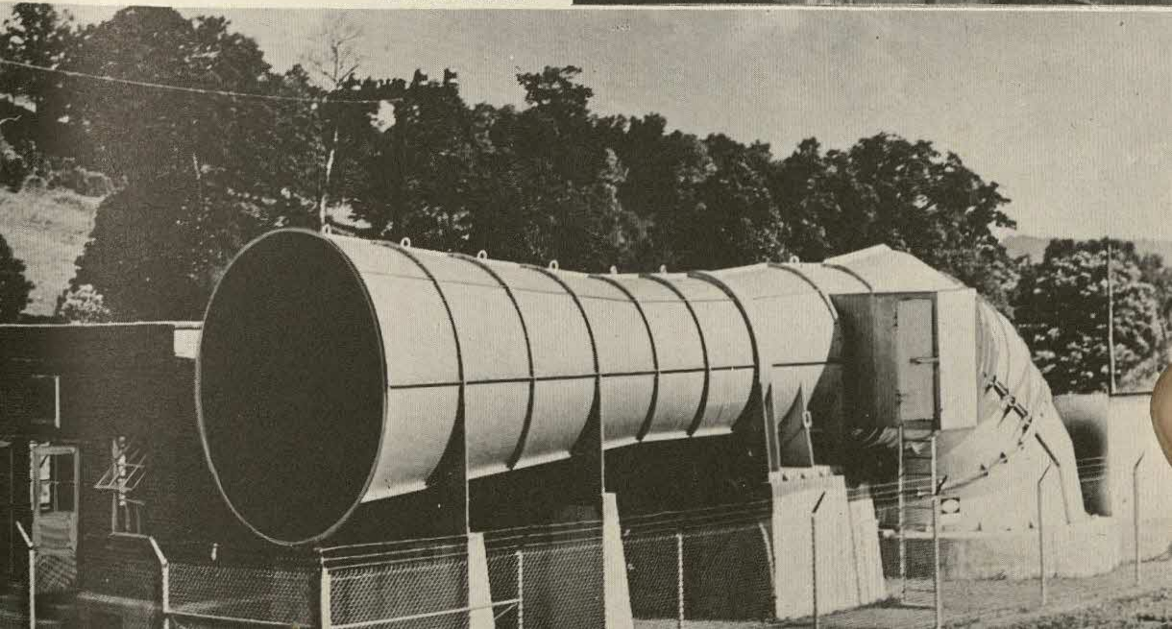
Coal Mining

Kinds of Coal Mines. When coal lies close to the surface it is obtained by strip mining. First the overburden of soil and rock, varying from a few inches to a hundred feet in thickness, is removed by bulldozers, excavating machines, or draglines. The exposed coal is then dug out by giant power shovels, some of which take forty-cubic-yard bites. After the coal has been mined, the "spoil" from another excavation is dumped in the hole and smoothed over. The land is then planted with grass or trees. About one fourth of the bituminous coal and one third of the anthracite mined in the United States is obtained by strip mining.

A drift mine is made by driving a horizontal tunnel through the side of a hill. Slope mining is used where the coal can be conveniently reached by a downward-sloping shaft. Slope mines are comparatively shallow but they are often very large. The workings sometimes extend for miles under the ground.

MINING BEGINS AND ENDS ON THE SURFACE. Right, large pieces of slate are removed by hand, one of several steps in processing coal. Below, a huge blower is used to supply a mine with fresh air. Mines use about twelve tons of air for every ton of coal they produce.

National Coal Assn.



Most coal is obtained from shaft mines, in which the workings are reached by vertical shafts. Some shaft mines are more than 4,000 feet deep in the earth. Every shaft mine has at least two shafts. Fresh air is forced into all parts of the mine through one shaft, and foul air and gases are driven out through the other. Either shaft may be used to remove the coal and to transport the miners and their equipment.

A main tunnel, or entry, extends in two directions from the bottom of the working shaft. Other entries run parallel to it, and still others extend crosswise. Thus a mine is laid out much like an underground city, with main streets, side streets, and alleys.

Mining Methods. Underground mines may be worked by the *room-and-pillar* method or by the *longwall* method. In the room-and-pillar method, the miners form a series of rooms as they work into the seams, leaving large pillars of coal to support the roof. Timber posts are also used to support the roof. When rooms have been formed for a hundred yards or so, the pillars are "robbed" and the roof is allowed to collapse.

In the longwall method, the miners work into the seam in long tunnels. Walls of coal are left between the tunnels to support the roof. Later, the walls are mined and the roof is allowed to fall in. There are several variations of this method. In one, the miners tunnel into the seam to the limit of the mine and then work back. The roof is temporarily supported by timbers, which are later removed to allow the roof to cave in.

Machines. Picks and shovels play little part in modern, mechanized coal mining. More than 97 per cent of the coal mined in the United States is mined by machine. Usually, the face of the seam is first undercut by a giant chain saw. A heavy chain armed with huge teeth slashes a gash, or *kerf,* several inches wide and from six to nine feet deep in the face. The kerf makes it easier to blast the coal from the face. Because less explosive is necessary, the coal is obtained in larger lumps, with greater value.

Next, a huge electric drill drills deep holes in the face. An explosive is tamped into the holes. The miners withdraw to a safe distance, and the "shot" is "fired." Some mines do not allow the shots to be fired until all miners have left the mine. The firing is done by a special crew. The coal broken loose is removed by the miners on the next shift, who then prepare the next shot. Compressed air is used instead of explosives to break the face in some mines.

Most coal is automatically loaded by gigantic machines which claw it up and carry it back to a mine car on a conveyor. An electric locomotive then hauls the cars to the foot of the shaft. In a small but growing number of mines, the coal is carried to the shaft on an endless conveyor belt.

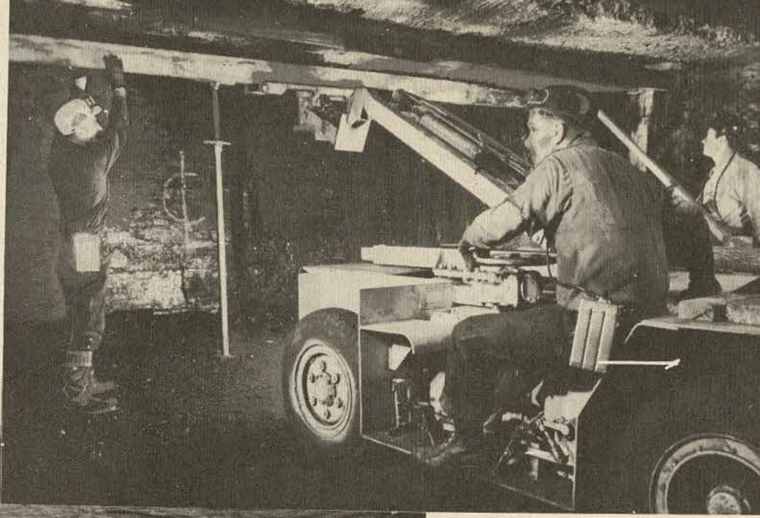
A number of machines have been developed, and still others are being developed, to eliminate undercutting, blasting, and loading. They mine and load coal in a single operation. The continuous miner has a head armed with whirling bits with which it chews its way into the face. The coal falls on a conveyor, which carries it back to a mine car. The continuous miner can mine up to two tons of coal a minute. The Colmol (coal mole) burrows into the face behind a head of ten revolving cutters, while a conveyor carries the coal to a mine car. Another machine slashes the face into sections, breaks the sections with battering rams, and conveys the coal to a car as it falls.

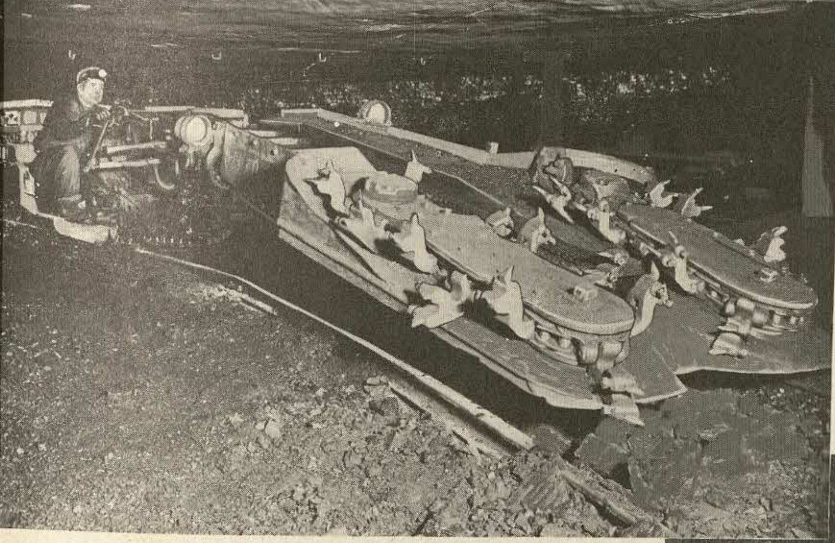
The titanic mechanical miners work far too swiftly for the locomotive-drawn cars to keep up with them. They must stand idle much of the time, waiting for the cars to be hauled to the foot of the shaft and back. To meet this problem, an extensible-belt conveyor has been developed. The head end of the conveyor, at the shaft, contains the machinery for lengthening and shortening the belt. The tail end moves about with the miner.

SAFETY ALWAYS

Right, a timbering machine places a beam to support a mine roof. Roof falls caused most mine accidents of the past.

Consolidation Coal Co.





NO MORE SHOVELS

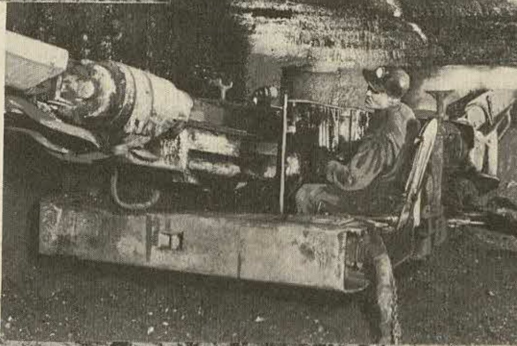
Left, the loading machine is the shovel of modern mines. It rakes the coal on to a conveyor, which deposits it in a mine car.

National Coal Assn.

A TITANIC MINER

Right, the continuous miner cuts the coal and loads it into a car in one operation.

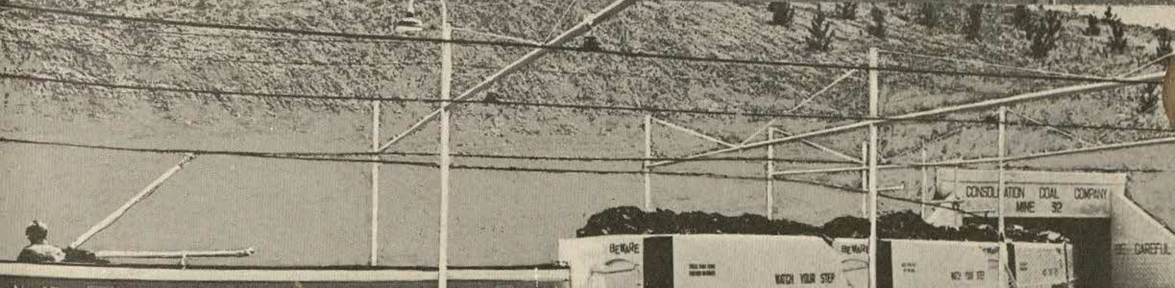
Jamison Coal & Coke Co.



OUT OF THE DEPTHS

Below, a powerful electric locomotive hauls cars of coal out of a slope mine.

Pittsburgh Consolidated



Hoisting the Coal. When the cars reach the bottom of the shaft, they may be driven on to a "cage" in which they are hoisted and dumped in the tipple on the surface. In some mines the cars are dumped into a "skip" at the foot of shaft, in which the coal is carried to the surface. In many mines, the cars are dumped on a conveyor belt which carries the coal to the skip.

The Tipple. The tipple is a processing plant at the mouth of the mine. Here the coal is first screened for size by passing it over shaking screens arranged one above the other, the uppermost screen having the largest holes. Next, the coal is rid of slate and stone and other impurities. In the wet process, this is done by washing it in a mixture of sand and water. The heavy slate and stone sink, while the lighter coal floats away. The coal may then be treated with oil or chemicals to make it less dusty. Finally, it is loaded into railroad cars.

Safety. Coal mining is a very dangerous occupation, and great precautions are taken to reduce the possibility of accidents. All miners must wear safety helmets, and safety shoes which have a curved piece of steel in the toecap. The helmets are worn because most mine accidents are caused by falling rock. Miners are forbidden to carry matches into a mine. If methane gas, or *firedamp,* is present, or if the air is dusty, an open flame might set off a disastrous explosion. Safety lamps are used to detect methane gas. If a blue cap appears on the yellow flame of the lamp, methane is present. A constant flow of fresh air dilutes the gas and carries it out of the mine. Drill holes are always tested for gas before the explosive is tamped into them.

Rock dust, a damp white powder made chiefly of limestone, is used to allay dust. After a face has been blasted, a blowing machine sprays the powder on the walls. The powder picks up the dangerous dry coal dust and cleans the air. It is also used to clean the air after a shot has been loaded.

First aid stations at carefully chosen locations are marked with green lights. The stations are provided with picks and shovels, respirators, and other equipment that might be needed in an emergency. First aid teams are thoroughly drilled in rescue procedures.

By these and other measures, mine accidents have been sharply reduced. Until about 1930, there were more than 2,000 fatal accidents in United States coal mines every year. In 1952, there were only 548.

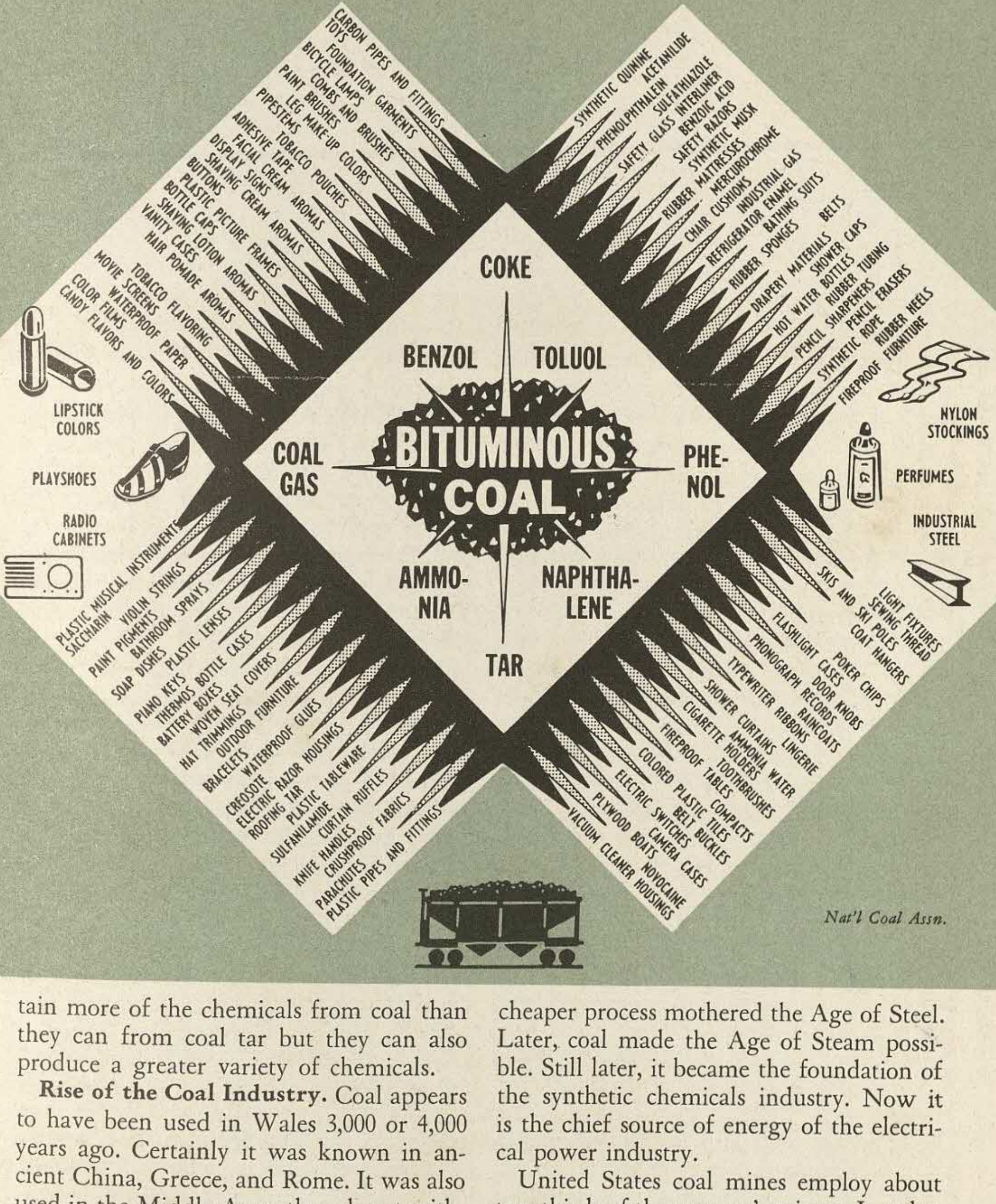
Treasury of Riches. Coal tar is a thick, black, evil-smelling substance that is obtained as a by-product when coal is coked to make coal gas or to provide steel mills with coke. Few things appear less promising. But since 1856, when William Henry Perkin, a young English chemist, stumbled on a way of making a dye from it, coal tar has proved to be a treasure house. Chemists can obtain an apparently endless variety of products from it. Fragrant perfumes are obtained from the foul-smelling liquid, and so are tasteful food flavorings. The long list of coal-tar products includes nylon, plastics, detergents, fertilizer, disinfectants, fumigants, insecticides, explosives, saccharin, creosote, carbolic acid, explosives, food preservatives, road tar, moth balls, shoe polishes, printing inks, phonograph records, photographic chemicals, and drugs. The drugs obtainable from coal tar include the sulfa drugs, the barbiturates, aspirin, and atabrine. Certain vitamins, too, are produced from coal tar. Almost all our dyes are made from coal tar, and so are bleaches for removing the dyes.

Chemists are now beginning to make synthetics directly from coal by treating a mixture of crushed coal and oil with hydrogen under heat and pressure. This process was originally used to make gasoline. Almost all of Germany's aviation gasoline was made in this way during World War II.

But gasoline cannot be produced by this process cheaply enough to compete with gasoline obtained from petroleum. On the other hand, the supply of coal tar falls far short of the industrial demand for coal-tar chemicals. By modifying the process, chemists have found that they can not only ob-

TRAINING COLLEGE
BAN

A FEW OF THE 200,000 PRODUCTS FROM COAL



Nat'l Coal Assn.

tain more of the chemicals from coal than they can from coal tar but they can also produce a greater variety of chemicals.

Rise of the Coal Industry. Coal appears to have been used in Wales 3,000 or 4,000 years ago. Certainly it was known in ancient China, Greece, and Rome. It was also used in the Middle Ages, though not without objection, for the foul smoke it gave off in the poorly-made fireplaces of the time was believed to cause diseases. Its use was made punishable in several places — by death under King Edward I of England.

Coal began to come into its own in the eighteenth century, with the use of coke instead of charcoal to smelt iron ore. The cheaper process mothered the Age of Steel. Later, coal made the Age of Steam possible. Still later, it became the foundation of the synthetic chemicals industry. Now it is the chief source of energy of the electrical power industry.

United States coal mines employ about two thirds of the country's miners. In value of products, among minerals industries they are surpassed only by the petroleum industry.

For additional reading consult the following articles:

Carbon
Coke
Charcoal
Combustion
Conservation
Diamond
Geology
Mining
Peat

FLYING MARINERS TO THE RESCUE! *U.S. Coast Guard Official Photo*

Today the Coast Guard uses helicopters and other aircraft in their rescue work.

Fringing the eastern coast of the United States, the ocean-tempered *Atlantic Coastal Plain* is generally level, well watered, and well populated. Although less fertile than the country's great Central Plain, it has been farmed since the earliest colonial days. Today it is dotted with farms, plantations, cities, and towns. New York and many other great seaports are on its coast, as are numerous winter and summer resorts. Along the Fall Line, which marks its western border, are many important industrial centers. See Piedmont Region.

COAST AND GEODETIC SURVEY, United States. About 150 years old, this Federal bureau renders many invaluable services. Its duties include the surveying and charting of the coastal waters, coasts, and interior of the United States and its dependencies. Mariners benefit from the printed and broadcast information resulting from its study of tides, currents, ocean depths, and navigation hazards. Its aerial photographs and maps aid road and railway builders, and its seismological observations help architects to design structures capable of withstanding earthquakes. It also produces aeronautical charts for the benefit of aviators, and much other valuable material.

Established in 1807 and originally called the Coast Survey, the bureau is now under the Department of Commerce. It conducts its work through its main office in Washington, D. C., and various district offices and field stations in the United States and its dependencies.

COAST GUARD. Year in and year out, the trained men of the United States Coast Guard serve as the watchdogs and lifeguards of all the navigable waters of the nation and its possessions. Their duties include saving the lives of shipwrecked persons, fighting fires aboard ships, assisting distressed vessels and water-traversing aircraft, and carrying medical and surgical aid to those stricken at sea.

The service operates lighthouses, lightships, buoys, fog signals, beacons, radio direction-finders, and other aids to navigation. It removes or destroys derelicts, wrecks, and other dangers to ships. It issues hurricane and other weather information about ocean areas regularly traversed by American aircraft and vessels. Its ships open up ice-blocked channels and ports. It conducts the international ice observation and patrol in the Atlantic, warns ships of icebergs, and blasts dangerous bergs to bits with explosives. It engages in flood-relief work and generally promotes the efficiency and safety of America's merchant marine.

In addition, the Coast Guard enforces, or helps to enforce, such maritime laws as those governing piracy, smuggling, quarantine, immigration, neutrality, the navigation and inspection of ships, and the loading of dangerous cargoes. It protects the fisheries and the game and bird reservations of Alaska, and also administers to the health and welfare of remote Alaskan settlements.

A branch of the nation's armed forces,

the Coast Guard is under the Department of the Treasury in peacetime. In wartime it becomes an active, fighting part of the Navy. Its ranks and pay are like those of the Navy, as are its uniforms, except for their insignia.

The Commandant, or chief of the Coast Guard, has his headquarters in Washington, D. C. Each of the districts, into which the United States, its territories, and its possessions are divided, is under a commander. The service maintains stations and navigation aids along the coasts, along the navigable rivers and lakes, and at various military bases under the jurisdiction of the United States.

The Coast Guard recruits and trains its own men, having its own training stations. Future officers are trained at the United States Coast Guard Academy at New London, Conn. The service also includes a Coast Guard Reserve, a military organization, and a Coast Guard Auxiliary, a volunteer, civilian organization of owners of boats, aircraft, and radio stations. During World War II, a Women's Reserve, called Spars after the service's Latin motto, *Semper Paratus* (Always Prepared), replaced men on shore duty, freeing them for combat.

History. The Coast Guard is an outgrowth of the Revenue Marine (later Revenue Cutter Service) set up in 1790 as a seagoing aid to the nation's customs collectors, and of the Lifesaving Service, established in 1871. In 1915 the Coast Guard was created by uniting these two services. The Bureau of Lighthouses became a part of the Coast Guard in 1939; the Bureau of Marine Inspection and Navigation in 1942. Its Search and Rescue Agency, for aiding in sea-air rescue work, was established in 1944.

The Coast Guard has played a part in every war the United States has fought since 1790. During World War II, for example, it rendered conspicuous service during the Allies' Normandy and other invasion landings. Its Atlantic beach patrol also caught several German saboteurs who had been carried to the United States by enemy submarines. Pamphlets pertaining to navigation and to the work of the Coast Guard are issued regularly.

A COAST GUARD ICEBREAKER IN THE ARCTIC

The Coast Guard, with its icebreakers and patrol ships, opens frozen shipping lanes and keeps icebergs from becoming a menace to ships at sea.

U.S. Coast Guard Official Photo

COAST RANGE. Along the Pacific shore of the United States and Canada rambles a chain of mountains called the Coast Range. Included in the range are mounts Diablo, Tamalpais, and Hamilton in California—the latter the site of Lick Observatory. The highest peaks in the California group are more than 8,000 feet above the sea. The Coast Range runs northward into the Olympic Peninsula west of Puget Sound and on to Vancouver Island.

The principal minerals found in the Coast Range are petroleum and gold. Because of its tremendous extent, the range has a wide variety of climate, vegetation, and rock formation.

THE BRAZILIAN COATI

COATI, *ko ah'te.* A southern cousin of the raccoon is the long-nosed coati of Central and South America. The coati is a meat eater, grubbing for worms and insects with its pointed, flexible snout, but feeding chiefly on eggs, young birds, and small animals. Its body is longer than others of the raccoon family, and it has a long tail. The two species of coati are the *Mexican* and the *Brazilian.*

COBALT, *ko'bawlt.* This steel-gray element is a metal used in certain alloys to impart hardness. Cobalt is never found free in nature except in meteorites. It occurs in ores in combination with other elements, including arsenic, sulphur, nickel, and silver. Almost 70 per cent of the world's cobalt is produced in the Belgian Congo.

Cobalt was formerly used chiefly to give a beautiful blue color to pottery glazes and glass. It was thus used in ancient Egypt and by the makers of Ming china. But it has become so important that little is now available for these purposes. It is a strategic material in the United States, and its allocation is rigidly controlled by the government.

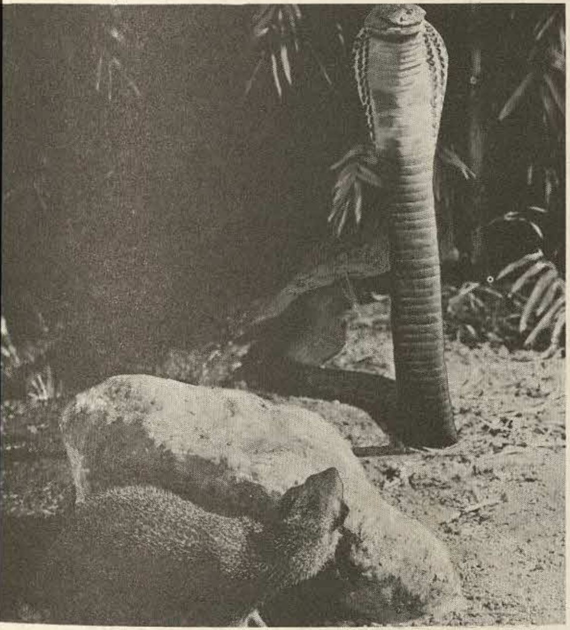
It is used chiefly to make hard, heat-resistant alloys. An alloy of cobalt and tungsten carbide, second only to the diamond in hardness, is used to make highspeed cutting tools and dies for drawing wire. Cobalt-alloy cutting tools retain their temper even when red hot and last far longer than other cutting tools. They are of vital importance in the speedy machining of weapons of war.

Cobalt is also used to make heat-resisting alloys for jet engines, gas turbines, and gun barrel linings. It is also used as an alloy in powerful permanent magnets which are used in the generators of aircraft and tanks, and in radio, radar, and television equipment. Cobalt is also used to bond enamel to metals.

Radioactive cobalt (cobalt 60) is produced by bombarding cobalt in an atomic pile. It is as effective as radium in the treatment of cancer, and it costs only one thousandth as much and is far safer to use. It is used in "needles" that are planted in diseased tissues and in "bombs" which beam gamma rays (X-rays) through the body to the diseased area. It can be used for longer periods and with more effect than radium because it produces only one tenth as many beta rays, which destroy healthy tissue. It is also used to make X-ray inspections of heavy castings.

COB'DEN, Richard (1804-1865). Throughout his business and political career, this English economist championed the cause of free trade and peace. He was born on a farm near Midhurst, Sussex, and received very little schooling. When fifteen years old, Richard obtained work in a London warehouse, where he showed such industry and ability that he soon was sent to Scotland and Ireland as a commercial traveler. Every spare moment was given to study, denied him as a boy. Later he became a partner in a successful calico-printing establishment.

During his extensive travels, Cobden studied the economic and financial systems of each country visited. In two pamphlets, *England, Ireland, and America* and *Russia,* he argued that the foundation of world prosperity was the free interchange of products among the different countries. He was one of the organizers of the league opposed to the Corn Laws, which levied duties on grains imported into England. Largely because of his vigorous campaign while a member of Parliament, the Corn Laws were repealed in 1846.



American Museum of Natural History

COBRA FIGHTS A DUEL

This Indian cobra, deadly to man, often loses its battle with the tiny mongoose.

CO'BRA or COBRA DE CAPEL'LO. One of nature's swiftest, deadliest poisons drips from the fangs of the hooded cobra of Southern Asia and Africa. Death may come within a few hours to a person bitten by this killer snake, although sometimes it does not occur for several days.

The cobra's bite is not always fatal, but antivenins should be administered as soon as possible. It has been estimated that only thirty-five die out of every hundred bitten. Often the serpent has lost much of its venom before it strikes its victim; and if the poison sacs are not well stocked with venom, the victim may recover.

Strange it is that although thousands die every year in India from the poison of the cobra, the natives will not kill the serpent. Their religion forbids it.

The peculiar expansion of its neck, or hood, gives it the name of *hooded cobra.* When aroused, ready to strike its prey, the cobra brings forward the flat ribs in the back of its neck, umbrella-like, spreading the skin and forming the beautiful but terrifying hood. The snake lives on small reptiles, birds, frogs, mice, and other small animals.

The *king cobra* is one of the most deadly in the Orient. It is about twice as long as the common cobra, often reaching a length of twelve feet. It feeds mostly on other snakes. This Indian cobra has long been famous for the singular performance in which it takes part. Daring men and women take upon themselves the profession of snake charmer, handling these fearful reptiles with perfect calm, even if their fangs have not been extracted. The charmers play flutes, and the snakes rise from their baskets and sway to and fro. Actually, they follow the swaying of the charmer rather than the rhythm of the music.

The African cobra, sometimes called spitting cobra, squirts its venom at the eyes of an enemy.

COB'WEBS. A maze of silken threads is the cobweb spun by a spider. Some cobwebs are loosely spun, and the threads crossing one another form an irregular pattern. Other webs are almost geometric in form. See SPIDER WEB.

COCHIN-CHINA, *ko' chin,* a former French colony, now located in the southern part of the republic of South Vietnam. The French won control of Cochin-China between 1859 and 1867, and it became part of French Indo-China.

Cochin-China is a rich farming land through which the great Mekong River and other smaller rivers run. Some of its products are rice, sugar cane, tobacco, corn, rubber, betel nuts, coffee, cotton, spices, coconuts, copra, teakwood, and fish. Water buffaloes, used as draft animals, and pigs are the chief livestock. Saigon, located in this area, is the capital and leading port of South Vietnam.

The Japanese occupied Cochin-China during World War II. It was a French self-governing republic between 1946 and 1949, when it became part of Vietnam, a state of the French Union. For further history, see FRENCH INDO-CHINA; VIETNAM.

COCHINEAL, *kahch i neel'*. An insect reddish in color, the cochineal was once a most important source of crimson and scarlet dyes. In its later stages it bears little resemblance to an insect, for it loses its legs and appears to be no more than a slight swelling on a plant. Found on cactus plants in Mexico and other warm countries—Algeria, Peru, Southern Spain, and Central American countries—it is brushed off gently and killed by heating in the sun, in ovens, or in hot water. About 70,000 insects make a pound of dye, or cochineal. The importance of cochineal has waned with the introduction of synthetic chemical dyes.

COCKATOO'. The Australian region is the home of the cockatoo, a parrot-like bird with a large bill, long wings and tail, and a distinctive feathered crest that can be raised at will. The cockatoo is easily tamed and sometimes can be taught to speak a few words. Most cockatoos are white, but some are tinged with yellow and red and black. They feed on fruits, insects, grain, and roots. The largest of the group is the *palm* cockatoo, sometimes two and one-half feet long. The smallest is the tiny *cockateel*.

COCKFIGHTING. Public opinion against cockfighting, a cruel and barbarous sport, has forced its disappearance from almost all the civilized peoples of the world. Known to have existed in ancient Greece and Rome, cockfighting was popular in England at various times, but it was outlawed by legislation forbidding the practice in 1849.

COCK'ROACH. Homes, restaurants, bakeries, hotels, and flour mills are often infested by a most obnoxious insect, the cockroach. The two most common varieties in America are the *German roach,* or *croton bug,* and the *Oriental roach,* or *black beetle.*

The roach breeds in dark, damp, warm places, hiding during the daytime in cracks and crevices, under floors, behind baseboards, and around sinks and water pipes. It lays its eggs in these places. It feeds on all kinds of food materials and will even gnaw leather and bookbindings, since it is fond of anything that has paste on it. The insect secretes an oily, disagreeable-smelling liquid, thus injuring food not so much by devouring it as by running over it and making it unfit for human consumption.

Cockroaches can be killed with poison baits or by fumigation, or they can be trapped. Commercial sodium fluoride has been found effective. It should be thoroughly dusted where roaches occur, especially in their breeding places.

COCOA, *ko'ko*. This name is applied to a powder made from the seeds of the cacao plant; it is also the name of the beverage made from the powder. Chocolate is also obtained from the cacao plant. See CACAO; CHOCOLATE.

COCONUT, or COCOANUT, *ko'ko nut*. Everything from cement to cake frosting is obtained from the coconut tree, a palm that grows in tropical countries throughout the world. Food, drink, shelter, and clothing all are furnished by it, and there is not a particle that cannot be used for some purpose. Because this tree is so valuable, it is the basis for millions of dollars' worth of trade every year, and gives employment to thousands of persons.

The coconut fruit is the best-known and most valuable part of the tree. From it we receive food, which may come shredded to our tables in the form of delicious cake or cookie frosting, or a refreshing and healthful milk. Copra, the dried ripe meat of the nut, furnishes oil for margarine, vegetable butters, pastries and candies, candles, perfume, cosmetics, soap, shortening, glycerine,

THE PARROT'S NOISY, HAUGHTY COUSIN—A COCKATOO

With his proud crest and pure-white plumage, the cockatoo is handsome indeed. He is not afraid of human beings, can be tamed easily, and can learn to speak a few words.

among other products. What remains of the copra after the oil has been pressed out provides a good food for cattle and other livestock.

The shell of the nut is made into combs, spoons, bowls, linoleum, and other articles, and its outer fiber can be manufactured into felt. The stem of the tree provides a hard lumber that takes a high polish, and so is useful in making furniture, in house construction, and in fashioning sailboat fixtures. Thatch for roofs, brooms, mats, baskets, and fodder are obtained from the long, broad leaves of the coconut-palm.

Even when it is cut down, the tree is still useful, for the juice in the stump can be made into wine or arrack. Yeast, vinegar, and gum are some other products of the coconut tree. The pulp of young coconut trees is said to be as healthful to infants as mother's milk. The coir, or outer husk of the fruit, or nut, is made into mats, doormats, brushes, and a splendid rope that is not affected by salt water.

Where the coconut first grew is a matter of dispute, but it is well known that the

VALUABLE PALM

Coconuts produce not only the familiar ingredient of confectionery, but oils used for candles and cosmetics, butter substitutes and insulation. Above, a Fiji islander goes after the fruit. Right, coconut, shell, and husk.

nuts, which are light and waterproof, sailed the seven seas long before man. They were washed up on the shores of tropical lands where they took root and grew, accounting for the fact that coconut trees grow thickest near the shore. They attain a height of between 60 and 100 feet, have smooth stems, and sometimes produce over fifty nuts a year. The age of the tree can be told while it is still living, by the rings on the outer bark left by fallen leaves. Each year, as the tree grows, the lower leaves fall off, leaving scars which the tree carries its entire life—usually between seventy and eighty years.

Coconut plantations are maintained in India, the East Indies, South Sea islands, the West Indies, and Brazil. The trees usually start producing nuts in their sixth year and increase the yield as they grow older.

The shredded coconut that we know so well on cakes and cookies is the meat that has been chopped and prepared for commercial use. In making it the nuts are steamed, then cracked, and the shell is removed. Then the kernel is trimmed, cut and shredded. Sugar, salt, and glycerine are added, and the mixture is cooked. It is packed in packages or cans for shipment. See COIR; COPRA.

COD. This excellent food fish is not only the basis of an important industry, but it has influenced the history of North America. Reports made by early travelers about the abundance of cod in New England and Canadian waters attracted the fishing fleets of Europe even before the landing of the Pilgrims. Many of the colonies were dependent upon cod fishing for a long time, both as a source of food and income, and the shipping industry for which New England has always been noted grew out of the trade built up by the early colonial fishermen. In Boston there is a memorial to the "Sacred Codfish," and the fish was pictured on the seal of Massachusetts Colony.

The cod, one of the most important food fishes in the world, is found on both sides of the North Atlantic Ocean. The leading fisheries belong to the United States, Canada, Great Britain. France, Norwav, and Sweden. Gloucester, Mass., has long been the center of the fishing industry in the United States, and every year millions of pounds of cod are prepared here for sale in markets all over the world.

The months from October to December are the best ones for fishing, but at all times of the year, small American boats set out from port bound for the fishing grounds of

COD FISHERMEN UNLOAD THEIR TREASURE

"Cod" is a magic word on the east coast of the North American continent. Each year fleets of boats like this take millions of cod. *National Film Board*

the Grand Banks, shoals near Newfoundland, or the George's Bank off Cape Cod. There, where the water is only a few hundred feet deep, the fishermen set out trawls, long baited lines that sink to the bottom where the fish are feeding. From time to time the trawls are pulled up to remove the fish and rebait the hooks. The fish are brought to the schooner, where they are split open and salted to preserve them until the ship returns to port. Some of the catch is packed in ice so that it can be sold as fresh fish. When the ship returns home, the fish are again salted and dried out, either on outdoor frames or in drying rooms.

Cod is sold in a variety of forms, such as dried, pickled, boneless, fresh, flaked, and shredded. Cod-liver oil, rich in vitamins, is obtained from the liver of the fish (see Cod-Liver Oil). Isinglass is made from its air bladder. The cod is greenish in color, with numerous brown spots, and has a rather flat body. The larger fish weigh about twenty-five pounds and the smaller about twelve, but occasionally one will weigh 100 pounds or more.

CODE NAPOLEON. The Emperor Napoleon is remembered not only as the leader of victorious legions, but as the man who gave the French people their private law and rights. Under the tyranny of the Bourbons, the people of France knew no law but the word of the king. So, in 1804, after the French Revolution, Napoleon had all civil law—rights and privileges of the people—gathered together and written into one document which came to be known as the *Code Napoleon*. This code welded together the Germanic law of Northern France and the old Roman law of the south. France is still governed by this legal system, now generally called *Code Civil*.

Wherever Napoleon's armies were victorious, this code was enforced, with the result that it is still the basis of law in Belgium and the Netherlands and has exerted great influence upon Germany and Italy. Latin American countries, and other nations which won their independence in the nineteenth century, have patterned their laws on the code. The laws of the American state of Louisiana and of the Canadian province of Quebec are based on it, because France once ruled these areas.

CODE WRITING. When messages are written in such a way that the meaning can be learned only through a key, the writing is said to be in *code*. The key to a code is very often a secret one.

Julius Caesar used the simplest form of code writing, the substitution alphabet. He employed the third letter of the alphabet following the one he wished to indicate. Thus, instead of using the letter *A*, he would write *D*.

The key to the code writing of Louis XIV was not discovered until 175 years after his death. A few famous codes have defied the experts of all times; but in general it may be said that no code is so intricate that someone cannot decipher it.

The most widely known code now in use is that of the Morse telegraph. Code books, containing groups of letters representing words or phrases, are provided by cable and telegraph companies. These codes are for brevity, not secrecy.

The diplomatic and the army and navy branches of the government, and some business houses, have their own secret code systems.

There are two kinds of ciphers: substitution and transposition. In writing substitution ciphers, other letters or numbers or symbols are used in place of the letters intended. In transposition ciphers, the regular letters are used, but the order in which they come is changed about, according to a key system.

In both the United States Army and Navy, experts have been trained to decipher code messages, with the result that both the making and the reading of such dispatches have been reduced to a science.

A new invention has replaced code for transmitting messages by radio telephone. The spoken words are "scrambled" automatically at the transmission point and "unscrambled" as they are received. They are unintelligible during transmission.

COD-LIVER OIL. The oil extracted from the liver of the cod is a valuable source of Vitamins A and D. The first of these substances makes for a higher degree of health and normal growth. It helps one to avoid colds and other infections and builds resistance in tuberculosis and other wasting diseases. Vitamin D is concerned in the development of bones and teeth. Lack of this vitamin in the food of children causes the deforming ailment known as rickets. These facts are responsible for the development of a thriving industry based on the extraction and preparation of cod-liver oil.

The oil is obtained from clean, fresh livers, usually caught in the cold months. They are immediately refined by a steaming process, and packed in tin-lined drums, in which the air has been replaced by an inactive gas. This insures a palatable and sweet oil, and conserves the vitamins.

From time immemorial, cod-liver oil has been used in Norway as a domestic remedy against disease, but it was not until a century ago that physicians confirmed its real health-giving power. As the oil is now marketed, its disagreeable taste and odor are disguised. It is taken in liquid form and in capsules. It is also possible to buy milk and bread treated with concentrated oil.

CODY, William Frederick (1846-1917). "Buffalo Bill" Cody was the last of the great scouts of pioneer days in America. Born in Iowa, he grew up in the saddle on the Kansas plains. When still scarcely more than a youngster, he was a courier for the Pony Express, riding through dangerous country.

His reputation as a fearless scout, perfect horseman, and expert hunter took him into army service during the Civil War. After the war, General Sheridan, needing a plainsman versed in the ways of the Indians, appointed Cody his chief scout for the campaigns against the prairie tribes. On occasion Cody rode one hundred miles a day to save beleaguered troops.

During the building of the Kansas Pacific Railroad, Cody was given the contract to supply fresh buffalo meat. In one season he killed more than 4,800 buffaloes. It was at this time that he won his nickname of "Buffalo Bill."

Courtesy Northern Pacific Railway

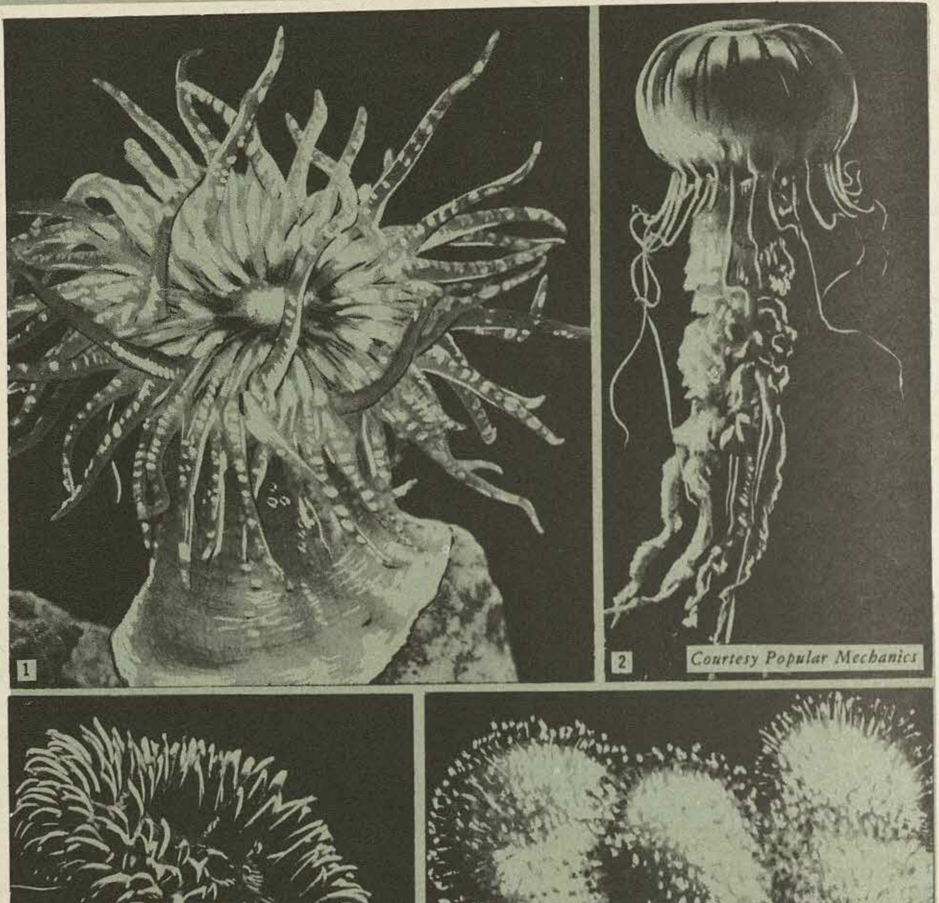
HEROES OF THE OLD WEST

"Buffalo Bill" Cody, with his friend, Sitting Bull, the Indian chief who later turned against all white men except Cody.

Rather than let the old West be forgotten, he collected a troupe of cowboys and Indians—some of whom had once been his enemies—and organized a "Wild West" show. He toured America and Europe and won worldwide fame. The fortune "Buffalo Bill" made with his show was invested in Nebraska and Wyoming lands.

In 1872 he was elected a state legislator in Nebraska. Later he was an officer of the Nebraska National Guard. He had a ranch in Wyoming where he conducted a school for roughriders. The town of Cody, Wyo., east of Yellowstone National Park, was named for him.

Cody died in January, 1917, in Denver, Colo. His grave is on Lookout Mountain, twenty miles from Denver.



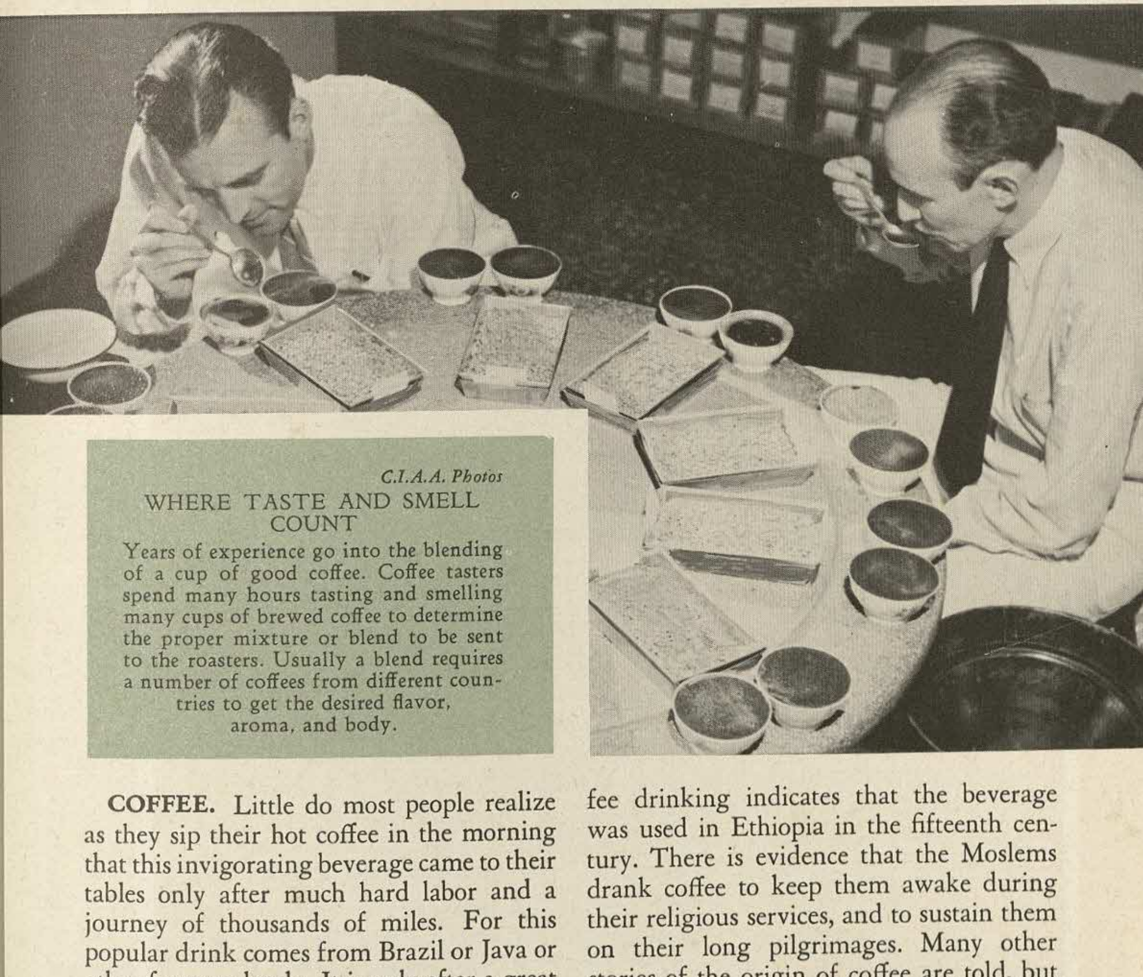
Courtesy Popular Mechanics

FATHER NEPTUNE'S STRANGE GARDEN

These highly decorative undersea animals belong to a low zoölogical division, Coelenterata, which includes the sea anemones, coral polyps, and jellyfish. (1) A common sea anemone, with its beautiful, glassy tentacle outstretched for food. (2) A compass jellyfish, which floats free. (3) "Dead Man's Hand," so-called for its swaying "fingers." (4) A Pacific green anemone. Like the others, this creature is brightly colored.

COELENTERATA, *se len tur a'tah.* Forming one of the lowest branches of the animal kingdom, the *Coelenterata* include the jellyfish, coral, polyp, hydra, and sea anemone. The name means *hollow intestine,* for the bodies of these simple organisms are generally hollow and pouchlike. The mouth is surrounded with numerous threadlike feelers, which are constantly in motion, reaching out to grasp food and passing it into the opening of the pouch.

Nearly all Coelenterata are marine animals. Two distinct types are known: one, the free-swimming, bell-shaped form; the other, a more or less cylindrical form, fixed to a support. Some, like the coral organism, build in populous colonies, stretching far across the sea bottom. Many of the Coelenterata show a great variety of color and are often called sea flowers.



C.I.A.A. Photos

WHERE TASTE AND SMELL COUNT

Years of experience go into the blending of a cup of good coffee. Coffee tasters spend many hours tasting and smelling many cups of brewed coffee to determine the proper mixture or blend to be sent to the roasters. Usually a blend requires a number of coffees from different countries to get the desired flavor, aroma, and body.

COFFEE. Little do most people realize as they sip their hot coffee in the morning that this invigorating beverage came to their tables only after much hard labor and a journey of thousands of miles. For this popular drink comes from Brazil or Java or other faraway lands. It is only after a great deal of special work that it is finally brought to the table.

The Story of Coffee. It is supposed that coffee was used in ancient times, but few records are available to prove this supposition. One of the first definite records of coffee drinking indicates that the beverage was used in Ethiopia in the fifteenth century. There is evidence that the Moslems drank coffee to keep them awake during their religious services, and to sustain them on their long pilgrimages. Many other stories of the origin of coffee are told, but most are fanciful tales.

It is believed that coffee found its way into Europe in the sixteenth century, reaching England for the first time about the middle of the seventeenth century. In 1652 coffeehouses became the vogue in London.

From the first they were so popular that they were general meeting places for people of all classes. As centers of political gossip they were frowned on by the wealthier ruling classes, and the latter became bitter opponents of coffeehouses. In fact, many were ordered closed because they were considered nuisances.

Germans first adopted the coffee-drinking habit during the Seven Years' War (1756-1763). There, coffee drinking was more popular with the lower classes and considered undesirable. Laws were passed prohibiting the use of coffee, but this action made the beverage even more popular than before. During the invasion by Napoleon, coffee became a luxury; the blockade so raised the price that the average person could not afford to buy it, and coffee drinking almost ceased.

Where Coffee Began. Most of the coffee used originally in Europe came from Arabia. For fifty years Arabia held the coffee trade without competition. Then the Dutch suddenly appeared in European markets with coffee from Java, in the East Indies. Later, coffee from the West Indies appeared, and from the West Indies it spread to Brazil in 1727. Now Brazil raises more than two-thirds of the world's supply. More coffee is shipped from Santos in Brazil than from any other port in the world.

Where and How Coffee Is Grown. Coffee trees thrive in sloping areas where a temperature of about 70° F. is common, and where rainfall varies between 70 and 150 inches annually. Slopes from 1,500 to 4,500 feet above sea level seem to be ideal. Exposure to eastern winds, though not strong winds, is also desirable in growing coffee. All these requirements are perfectly met in Brazil and in no other part of the world. This fact accounts for the great importance of the industry there.

Coffee seeds are sown in pots and seedbeds and are cultivated there for about a year. The small saplings are then set out on hillsides or slopes about ten feet apart and are shaded by corn, castor-oil plants, or banana trees, grown between the "hills" of coffee. There the coffee trees mature and generally produce their first good yield when about five years old. The life of a coffee tree varies, but sometimes it produces for nearly forty years. In the meantime, it is carefully pruned and held to a height of six to eight feet. Allowed to grow wild, a tree may reach a height of ten to twenty feet; but it is of little use commercially when grown in this way. It is only by constant pruning that the trees are forced to produce heavily. Care must be taken, however, not to "overprune" the trees, thereby greatly weakening them and making them a prey to disease.

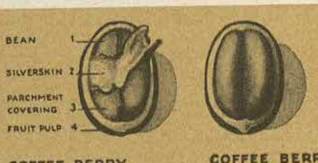
The leaves of the coffee tree, which is an evergreen, are dark green and appear waxy on the upper surface. The blossom of the plant is white and grows in the axils of the leaves. When the blossoms fall off, they are replaced by the clusters of coffee berries—red, round fruits greatly resembling cherries. Each berry is divided into two cells, a cell containing a single seed, or bean. At the time of the harvest, these seeds are a light-green color.

Harvesting the Coffee Crop. The time of harvesting coffee varies in different parts of the world. In Java, picking time comes the first four months of the year; in Ceylon, between April and July, with sometimes a small second crop between September and December. In Brazil, harvesting lasts from May to October.

Harvesting is remarkably easy, for a sheet or canvas is placed under the tree and the berries shaken onto it. The berries are then dried, preparatory to hulling and shipping. An average yield is one to two pounds per tree.

Drying Coffee for Shipping. One of two methods is generally used in drying. The old method was to spread the berries on a great stone floor in the sun and let the sunlight dry them. Provision had to be made to protect the berries if a storm should suddenly occur. After being dried, the berries were pounded to remove the hull. In the pounding process, many of the beans were broken, greatly lessening their market value.

The newer method is called the wet proc-



COFFEE BERRY HALVED, SHOWING SINGLE COFFEE BEAN.

COFFEE BERRY WITH HALF OF FRUIT PULP REMOVED, SHOWING TWO COFFEE BEANS IN PARCHMENT COVERINGS.

4

BERRY PICKING TIME

Coffee beans are called berries by the growers. (1) The picked berries are tossed on a screen to help separate them from pieces of twig, stems, and other undesirable matter. (2) The knack of stripping the berries from the branches requires skilled, rapid hands. The average tree produces about two pounds of coffee a year. (3) In Brazil the semesters of the school year are especially arranged so that the whole family can help harvest the crop. An average family can tend 8,000 trees a year. (4) A berry with half of the pulp removed to show the two coffee beans inside each of the parchment coverings.

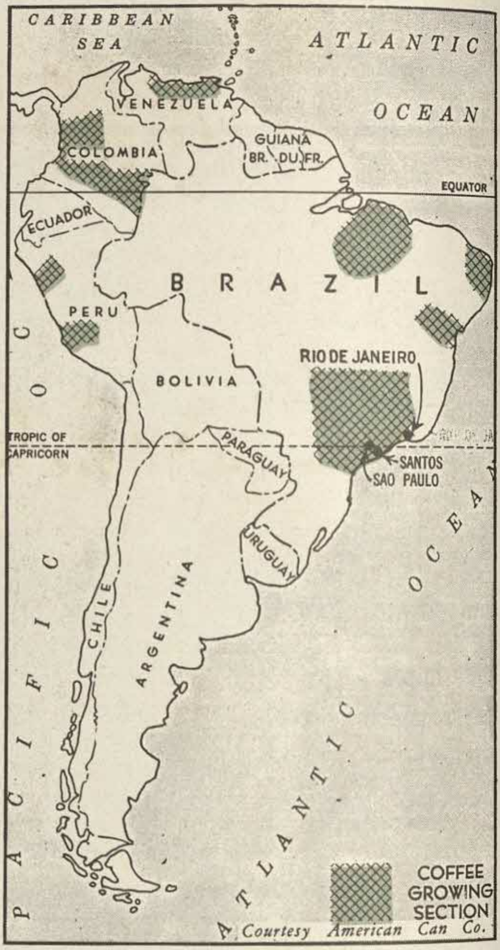
UPI

ess. The berries are dumped into tanks or vats of water. To speed up the process, water pipes in the fields carry the freshly picked berries to the great soaking vats. The mature berries float at the top of the tanks; the green and worthless ones sink to the bottom and are then thrown away. From the vats the berries pass in a stream through a pipe to a pulping machine which tears off the hulls without damaging the beans. A thin skin enclosing the beans is next removed by a high-pressure stream of water. The inner, sticky pulp is then removed from the beans by a special machine with copper cylinders, which rubs off the pulp without injuring the parchment.

The coffee bean, now surrounded only by a parchment and a silver-skin layer, is known as "parchment coffee." After being thoroughly washed, it is placed in the sun or in steam-heated drying rooms to dry completely. A "peeler" now removes the parchment, and the coffee goes to the graders. Grading is necessary because coffee varies considerably in size, and roasting is done most easily when coffee beans are uniform. Otherwise, some beans will be over-roasted, others under-roasted.

The roasting is usually done by the wholesaler near the market, the grinding by the retailer. Usually it is better for coffee to be roasted and ground just a short time before it is to be used. Often both roasting and grinding will be done by the wholesaler and the coffee "canned" in airtight containers, which will keep the coffee fresh for a long time.

The World's Largest Producers of Coffee. Although nearly all the coffee consumed in the United States comes from Brazil, smaller quantities are also obtained from other South and Central American countries, Africa, Asia, and Indonesia. Coffee is the chief export crop of six countries of the Western Hemisphere. Java coffee comes from Indonesia; Mocha is from Arabia or a neighboring state. Coffees are blended to suit the tastes of consumers.



Courtesy American Can Co.

SOURCE OF THE WORLD'S COFFEE

Nearly all of the coffee we drink comes from South and Central America. Brazil grows two thirds of this, and most of the rest comes from Colombia.

So small is the amount of coffee raised outside Brazil that if the rest of the world ceased its cultivation, Brazil could still supply the wants of all nations. In fact, the shortage would be far less than that suffered when Brazil has a poor crop. In normal times Brazil withholds millions of tons of coffee from the market each year. In the past this surplus was destroyed, but now it is used in making a variety of products, ranging from fuels to plastics. Other major producers are Colombia, Venezuela, Guatemala, and El Salvador.

Who Uses the World's Coffee? The United States leads the world by a wide margin in the use of coffee. The per capita consumption is something around sixteen pounds annually. Many people object to coffee because it contains caffeine, a drug. Taken in small amounts, caffeine is stimulating, but used in excess it makes people nervous and disturbs their sleep.

How Coffee Is Made. There are many methods of preparing coffee for the table, but the ones usually followed are the *boiling, percolating,* and *drip* processes.

In the boiling process, as in the others, the coffee should not be actually boiled, as it gives the beverage a bitter taste. It should be heated to a point just below boiling, and the steam retained. The oils in coffee are thus retained and give off a pleasing aroma. Water in the coffeepot may be cold or hot at the start, and the time for cooking will vary accordingly. Ordinarily this method is spoken of as "boiling," although the coffee actually does not reach the boiling point.

In percolating coffee, the roasted, ground coffee is placed in the top of a container, with water below. As the water reaches the boiling point, it bubbles up, flowing over the coffee and carrying the brown liquid to the bottom. By this method, the coffee and water never come in contact except as the boiling water sifts through the coffee, like a fountain throwing its spray back into a pool.

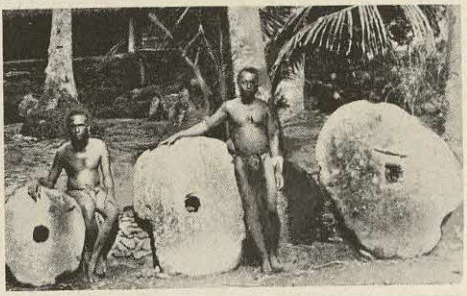
Drip coffee is made in much the same way as percolated coffee, the difference being that water drips through numerous small holes and flows through the ground coffee below, carrying with it all the flavor. In this method it is essential that the coffee be ground extremely fine. Pulverized coffee is also used in the upper bowl of glass coffee-makers. After steam pressure has forced up boiling water from the lower bowl, a filter in the base of the coffee compartment permits the enriched liquid to return.

Within modern times instant coffee has become a convenient and popular beverage. Instant coffee is a fine powder which is made by evaporating an infusion of coffee. To obtain a refreshing cup of coffee the user simply pours hot water over a small amount of the powder and stirs it until it has dissolved.

COHESION, *ko he'zhun.* We can easily pull a lump of clay into two or more parts, but it is not so easy to break up a piece of iron. The force with which the particles, or molecules, of iron or any other substance cling together is known as cohesion. The clay particles have some cohesion, but not as much as those of iron. Liquids have even less, and gases seem to have none at all.

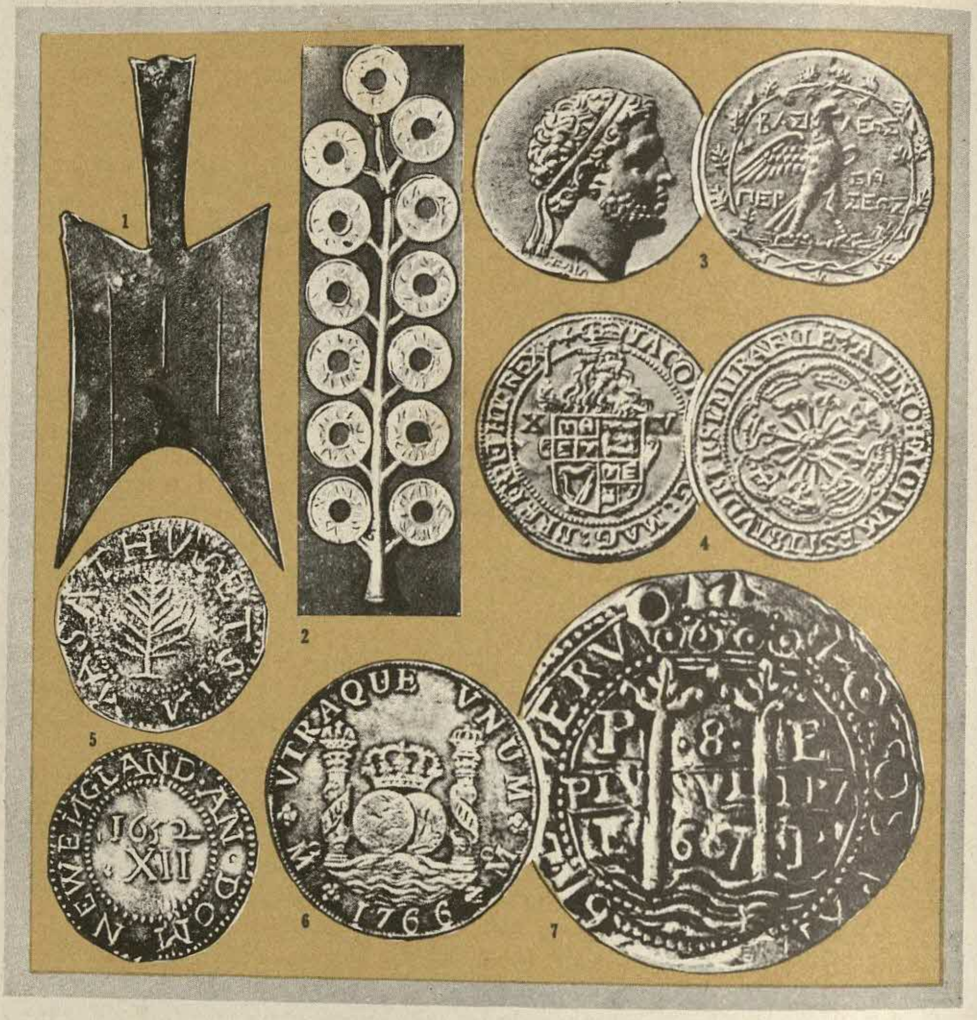
It is frequently important to know the strength of cohesion in a substance, and the particular way in which it acts. Concrete, for instance, although it will bear a load of 2,500 pounds to the square inch without crushing, will pull apart about ten times as easily. So, for buildings and bridges, concrete is reinforced by steel, which has so much more cohesion that it will withstand a pull of 60,000 pounds per square inch. Various kinds of steel and iron also differ in brittleness, ductility, malleability, and other properties because of differing degrees of cohesion existing in the metals in question.

The property which causes two different substances to stick together is called adhesion.



MONEY BY THE TON IN YAP
Weight limited the circulation of ancient stone coins once used in the Caroline Islands.

COINS AND COINAGE. Over four centuries before the birth of Christ, in the city of Sparta the government is said to have used huge iron bars as coins to prevent hoarding and to keep the people from carrying their money from the city. However, in other parts of Greece the use of small pieces of precious metal as a medium to take the place of barter probably began before 700



THESE JINGLED IN THE MONEYBAGS OF OLD

These coins could tell a tale! (1) Ancient Chinese "spade" coin, 2,000 B. C. (2) Malay "tree" money; a single casting in tin, the coins to be broken off. (3) Early Greek silver coin. (4) English gold piece, from the reign of James I. (5) Rare American Pine Tree shilling. (6) Spanish "piece of eight." (7) Peruvian coin buried by pirates.

B. C., and the age of Imperial Rome found the "heads" of the emperors upon a great variety of coins of intrinsic value, which were accepted almost everywhere in Europe.

Today, coining has become a fine art. Alloys of silver, copper, nickel, gold, and coinage bronze are stamped by government mints into coins which have a stated guaranteed value slightly greater than that of the metal, to prevent them from being melted down and sold as bullion. They are now made of intricate design so that they cannot be easily counterfeited. The coins of higher denominations are made of precious metal for the purpose of having them small and easy to carry. Although private individuals once made coins, they are now issued only by sovereign states.

In the United States, all coins are made under the supervision of the Treasury Department operating through the mints. The mints make *assays* of ores for mining interests, to determine their content of precious metal (see Assaying). To encourage hoarders of silver bullion to change it into coins, most governments make no charge for assaying. After it has been assayed and its value determined, the owner delivers his bullion to the mint and receives an equal value in finished coin.

The actual making of coins has become a highly complex process. Usually, silver bars or refined gold ingots are purchased, although some mints in the United States and Canada accept unrefined metal. These mints first melt the metal to be used and cast it into a bar. It is then refined, and another metal is added to it while in liquid form to make it harder. Gold, particularly, is so soft a metal that coins of pure gold would soon wear away through use. The proportion of alloy varies, but is generally about one ninth of the weight in the case of silver. The metal is now cast into ingots and taken through heavy rolls, where it is made into a long, thin bar or strip. This strip is *annealed* to make it soft, and then *drawn* to make the metal of the desired thickness for the coin.

The thin strip is cut out into blank coins by means of a steel press or heavy punch. The metal which remains after the cutting is remelted and goes through the process again. The blanks are weighed and filed down if too heavy, and then *milled*, so that the round edge turns out. This job of weighing must be very accurate, because, according to law, the weight must not vary more than two-hundredths of an ounce per $1,000, in the case of silver coins.

Finally, the blank is converted into coin by being stamped with an impression from engraved dies of carbon steel. This is done by means of a huge *coining* press which runs off 100 units a minute or more, and prepares the coins for the Treasury, from which they go into circulation by way of the banks.

Since 1933, the United States has discontinued the coining of gold coins, which were formerly used for large denominations. The silver coins today are of values $1, 50 cents, 25 cents, and 10 cents. The five-cent piece is nickel and the one-cent piece is copper. See Mint; Money.

Separate articles on coins used in various countries appear in these volumes. See:

Cent
Crown
Dollar
Farthing
Franc
Guilder
Guinea
Lira
Livre
Penny
Peso
Peseta
Piaster
Pound
Ruble
Rupee
Shekel
Shilling
Sovereign
Yen

COIR. Great ocean liners are usually held to their docks by strong rope cables made of coir, the brown husk of the coconut, whose tough fiber lasts well in salt water. Coir is also employed in the manufacture of mats and coarse brushes and as a stuffing for mattresses. It has become an important export from the tropical Pacific regions.

COKE, *koke.* There are at least two kinds of coke, both of which consist chiefly of carbon. One kind is derived from the refining of petroleum; it is very pure carbon and can be used in electric batteries. The coke we know best, however, is a fuel, made by extraction of the volatile (easily evaporated) constituents of soft coal. Some fuel coke is a by-product of the making of illuminating gas from coal, some is produced by heating coal in a closed chamber. The specially made coke is superior to the by-product, particularly for the smelting of iron and other metals, because it has strength enough to support the ore and is at the same time porous enough to permit the passage of air.

COLD STORAGE. Since the invention of the first compression refrigerating machine in 1834, the advantages of cold storage have become more and more apparent. Wide use of refrigeration, however, has come only within the past generation. Today we find cold storage a necessity from the standpoint of economics, health, and convenience.

The diet of mankind has been greatly improved both in variety and quality by cold storage. All through the year it is possible to have food from even the most distant countries at prices within the reach of the great majority of people. The public no longer looks disdainfully and suspiciously at refrigerated foods, as is proved by the great consumption of these commodities. The cold-storage label on refrigerated foods, required by law, has ceased to be held in disrepute.

In recent years extensive research has been made regarding temperature, humidity, and the physical conditions necessary for successful cold storage. For example, an egg only a few days old but improperly stored will be inferior in quality to another egg of the same age carefully and immediately cooled and stored under the best conditions possible.

A New Industry. A recent development in cold storage is the quick-freezing method by which foods in small units of "family" size can be frozen within the container. Every year this industry has grown fifty per cent over the previous year. Advancing from such limited cold-storage commodities as chickens, eggs, and fish, there are now offered such delicacies as strawberries in November; asparagus, peas, and string beans in October; and corn on the cob in the middle of winter. There are hundreds of varieties of quick-frozen foods offered in the markets. They range from peaches and berries to beefsteaks.

From Garden to Warehouse in Five Hours. Just how foods are quick-frozen and delivered to the warehouse is a remarkable story indeed. If the packer is concentrating on vegetables, for example, his garden will be large—possibly several thousand acres. Vegetables are planted according to a definite schedule, so many acres of peas on one date, so many of beets on another, and so on. Moreover, the packers know just when each planting will mature, and the refrigerating trains are on hand at that time. Fast work is necessary, for the vegetables cannot be packed except in prime condition. While the freezing apparatus is being set up, the vegetables are cut and sorted. Then a spray of steam is passed over them. This is of great importance, as the steam stops nearly all the enzyme action which would lead to decay.

Now the vegetables are placed in cartons and sealed. They are immediately quick-frozen with dry ice, liquid air, or brine at 10° to 50° below zero. When they are quick-frozen at this low temperature, millions of tiny needle-like crystals form in the cellular structure and pack themselves together. At a warmer temperature the crystals would enlarge and break the cell walls, resulting in a loss of the mineral salts and liquid when the vegetables were thawed.

It has been proved that the vitamin content of vegetables quick-frozen at 50° below zero does not diminish; in some instances it has been found to be even higher than in fresh vegetables sold in the markets. In trucks or specially insulated refrigerator cars, these quick-frozen foods are taken to central warehouses, where temperatures vary from zero to 10° below, depending upon the products to be stored.

The full significance of this great new industry is as yet unknown; but certain it is that if an emergency threatened, vegetables and other foods could be stored for several years.

COLD WAVE. When skies are clearing and the barometer rises, watch out for a cold wave. Those are usually the signs of a sudden drop in temperature, especially when the wind blows from the cold north. The weather man calls it a cold wave if the temperature drops 16° to 20° in a day, although this standard varies in different parts of the world. Temperature changes as great as 50° overnight may occur. Sometimes cold waves push suddenly into the South, nipping crops that cannot survive freezing weather. But the weather bureau can predict cold waves a day or more in advance and precautions can be taken. The United States and Canadian governments co-operate in exchanging data for forecasts. Through newspapers and radio, weather bureaus in both countries publish warnings to farmers and shippers.

COLERIDGE, *kole'rij,* SAMUEL TAYLOR (1772-1834). English poet, critic, and philosopher, Samuel T. Coleridge produced scant measure of literature to entitle him to a place among the foremost English writers, but he does stand in the front rank among them. He stands, too, as one of the most remarkable and one of the most tragic men of his time.

He was born at Ottery Saint Mary, Devonshire, England, the son of a vicar and schoolmaster. His father died when Samuel was nine, and the next year the lad was sent to the Charity School of Christ's Hospital, where he seems to have remained several years without returning home. At nineteen he entered Cambridge, but did not take a degree. Here he lived much among books, a tireless reader, dreamer, and student of life.

Coleridge and Robert Southey, whom the former met on a visit to Oxford, were fired by the ideals of the French Revolution. They planned a utopian settlement in America on the Susquehanna River, but the young enthusiasts never had the money to come to the scene chosen for the "Pantisocracy."

In 1795 Coleridge married Sara Fricker, and the two set up housekeeping in a cottage at Nether Stowey in Somersetshire. In 1796 Wordsworth and his sister Dorothy became their neighbors, and in 1798 the two poets published *Lyrical Ballads,* a volume of verse that was destined to start a new epoch in English literature, the Romantic era.

These two poets were alike in their dissatisfaction with the formal verse of the Classic poets, but they did not agree on the method of expressing the new forms. Wordsworth chose to write of familiar themes, endowing them with spiritual beauty. Coleridge chose the supernatural and romantic, translating his subjects into reality by human and sympathetic treatment. He contributed only *The Rime of the Ancient Mariner* and two lesser poems, but his *Ancient Mariner* is one of the great masterpieces of English verse.

In 1799, with the Wordsworths, he studied in Germany, leaving his family largely to the care of Southey, who had married Mrs. Coleridge's sister. Later he resided in the Lake District near Wordsworth and Southey. When rheumatism afflicted him, he spent two years in Malta and in Rome.

Then a severe dejection shadowed Coleridge's life. He was struggling to overcome the habit of opium, acquired when he suffered from rheumatism. By the time he was thirty, this weakness, his lack of application, and his want of practical sense were his undoing. Yet, even though broken in body and in spirit, he still had flashes of brilliance. Byron, Shelley, Keats, and other great men sought him out for his masterly conversation.

Coleridge spoke and wrote the only high criticism of his time. His analysis and appreciation of Shakespeare are unexcelled in the field of English criticism. His philosophical writings are a challenge to the student. His introduction of German literature and philosophy to England would alone place him high among the forces of his generation.

The really great work of Coleridge would make only one book, but it would be a golden book. His best poems are *Kubla Khan, Christabel,* and *The Rime of the Ancient Mariner.* From the familiar last poem, the imagery and melody of such lines as

> Ice mast-high, went floating by
> As green as emerald

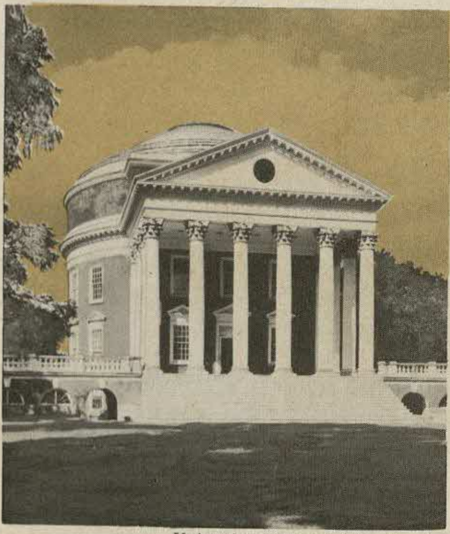
and

> A noise like of a hidden brook
> In the leafy month of June,
> That to the sleeping woods at night,
> Singeth a quiet tune

rank him among the great masters of poetic imagery.

His chief prose works are *Biographia Literaria,* dealing with Wordsworth's theory of poetry and with Coleridge's own sound and illuminating ideas; *Lectures on Shakespeare,* reflected today in most annotated editions of Shakespeare; and the profound *Aids to Reflection,* devoted mostly to religion and philosophy.

COLLAT′ERAL. To obtain a loan from a bank or loan company, it is usually necessary to deposit some sort of collateral, or security, as a guarantee of repayment. Legally, collateral thus means anything of value pledged to guarantee the performance of an act, and may be in the form of bonds, stocks, or anything else which can be sold for cash in case a borrower fails to pay his debt. In the event of non-payment, the debtor forfeits his collateral. If, however, the value of the collateral proves to be more than enough to repay both debt and costs, the debtor receives the remainder.



University of Virginia News Service

THE UNIVERSITY OF VIRGINIA

COLLEGES AND UNIVERSITIES. Today it is commonly said that most parents hope to send their children to college. This statement, however, is understood to refer to almost any educational institution beyond the high-school level, whether college or university. The distinction between college and university is not clear in the minds of many persons. In the United States a college is an institution requiring for admission the completion of a four-year course in a standard secondary school, or the equivalent, and offering a four-year curriculum leading to a degree. A university is a group of colleges and professional schools under a single governing body. Thus a college may function as a separate organization, or it may be included among the departments of a university. A college which offers courses in the cultural subjects —language, history, philosophy, and the like—is designated a college of liberal arts.

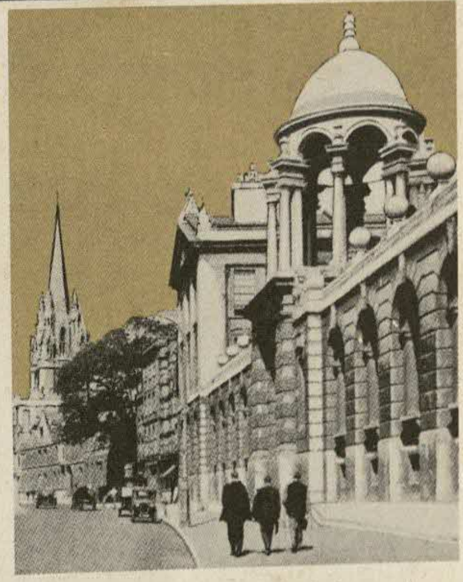
Graduates of a college of liberal arts receive the degrees of bachelor of arts (A. B.), bachelor of science (B. S.), and bachelor of philosophy (Ph. B.). On completion of a course leading to one of these degrees, the student mav pursue graduate courses in selected departments of a university, receiving the degree of master of arts (M. A.) or of doctor of philosophy (Ph. D.), according to the time devoted to graduate work. There are also special degrees provided for graduates of professional schools—degrees in medicine, dentistry, architecture, civil engineering, and so on.

The typical college or university is not only a "community of scholars," as defined by one American college president; in its physical aspects it consists of a campus with buildings which house administrative offices, classrooms, experimental laboratories, and libraries. Students often live in large dormitories. The combined value of more than a thousand American college "plants" has been estimated to be in excess of ten billion dollars. The college fraternity and sorority, a type of student club which was a product of the last century, provide group activity and contribute to social life. Most of these organizations maintain houses near the campus for the residence of their members.

Athletic activities have become a dominant part of college life. Football stadiums, seating many thousands, are maintained by many colleges and universities. In addition, they maintain a varied list of so-called "extra-curricular" activities, which are instrumental in creating leadership and well-rounded personalities. These activities include dramatics, the publication of newspapers and magazines, debating societies, and other types of clubs.

Brignolo

UNIVERSITIES — OLD AND NEW
Generations of scholars have walked the High, main street of England's famous Oxford (right). Above, the modern University of Miami.



Supplementing college work, many institutions maintain home-study courses, extension departments, and night schools for students unable to attend regular classes. Within recent years, too, many junior colleges have been established in connection with public-school systems. These offer the first two years of the college course for those who desire to continue their schooling, but cannot attend a regular college. Major schools accept students from accredited junior colleges.

Classifications. Colleges and universities may be divided into three groups: (1) those established by state legislatures and supported by public taxation; (2) those maintained by private funds or endowments and governed by a board of trustees; (3) those maintained by religious groups. In many states, the state-controlled university heads the educational system and provides the course of study for the public schools.

The number of college graduates in America exceeds that of any other country. College attendance is rapidly outstripping the facilities and most schools have adopted stringent entrance requirements. In 1890, 14,306 students were graduated from colleges; nowadays several hundred thousand students, both men and women, are yearly graduated from institutions of higher learning in the United States alone.

Among the privately endowed schools, Harvard, Yale, Columbia, and Chicago lead in wealth. Various organizations have

John W. Barry

WHAT MAKES A COLLEGE

Inside college and university walls, young people build knowledge and skills, as in this architectural design class.

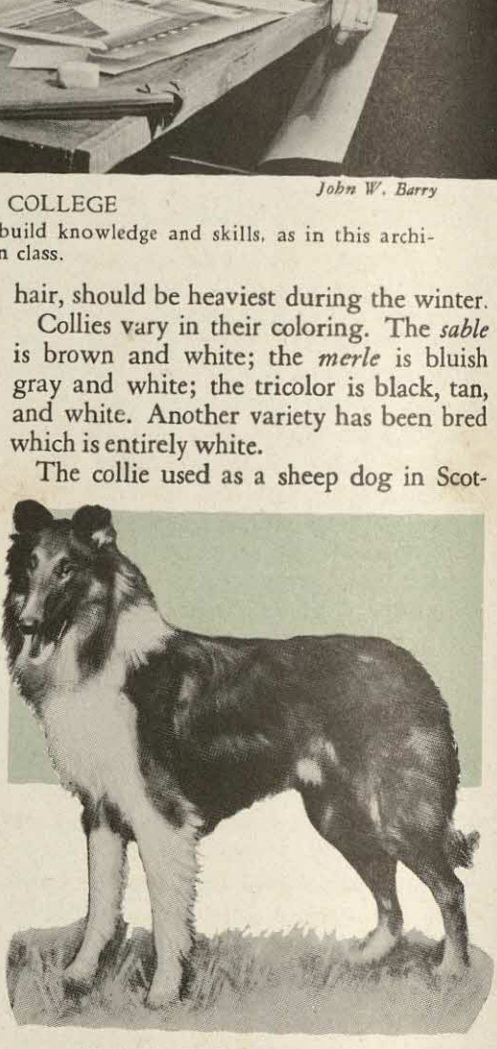
ranked American institutions according to their academic standing. The Rosenwald Foundation report of 1935, based on the excellence of departments in the universities, placed Harvard first, with Chicago, Columbia, California, and Yale next in order.

There are a large number of public-supported and endowed institutions in Canada. The Universities of British Columbia, Alberta, Saskatchewan, and Manitoba correspond in a general way to American state universities. In Quebec, the two leading institutions are McGill, (Protestant) and Laval (Catholic). Among the noted universities abroad are Oxford, Cambridge, Berlin, Heidelberg, Prague, Vienna, and Edinburgh.

COL'LIE. Intelligent, loyal, and dependable, the collie is descended from a Scottish breed originally used in tending sheep. This beautiful dog stands from twenty-two to twenty-four inches high at the shoulder and weighs from fifty to sixty pounds. It has a long muzzle, narrow head, and erect ears which droop forward at the tips. The tail is heavy and curls upward only at the tip. The coat and ruff, or chest hair, should be heaviest during the winter.

Collies vary in their coloring. The *sable* is brown and white; the *merle* is bluish gray and white; the tricolor is black, tan, and white. Another variety has been bred which is entirely white.

The collie used as a sheep dog in Scot-



MAN'S TRUSTED FRIEND

The collie, a beautiful and intelligent dog.

land is somewhat smaller, with a broader head and shorter hair. Although he may not be so beautiful in form as other collies, he is much more interesting to watch. The shepherd collie can separate his master's sheep from a mixed herd and drive them at just the right speed to a distant fold. Sometimes these useful collies assume complete charge of a flock of sheep for a day and give as good care as a man entrusted with the same task.

COL'LINS, MICHAEL (1890-1922). An immortal name in Irish history is that of Michael Collins. In the creation of the Irish Free State, Collins took an active part and directed the resistance against English rule. During the Easter uprising in 1916, he was captured and imprisoned for about a year. In 1918 he was elected a representative of the Sinn Fein from county Cork. In jail again for a time in 1918, he afterward eluded arrest, although a price was put on his head.

When Eamon de Valera failed in his negotiations with Lloyd George in 1921, Collins and Arthur Griffith brought about peace and the formation of the Irish Free State. However, Collins' brilliant career was cut short a year later, when he was assassinated by a political opponent while on his way to church.

COLOMBIA, *ḳo lome'be ah.* Until 1903 the narrow neck of land now occupied by the Republic of Panama was a part of Colombia. Then Panama became independent, the United States obtained the right to construct the Panama Canal, and the northwest boundary of Colombia receded to the point where the South American continent touches the Isthmus of Panama.

The isthmus separates Colombia's coast line into two almost equal parts; its northern coast is on the Caribbean Sea, an arm of the Atlantic; its western shore follows the Pacific. Colombia is the only South American country having a seacoast on two oceans. Including all indentations, the coast line is about 2,000 miles long. To the east of Colombia lie Venezuela and Brazil; and to the south are Ecuador and Peru.

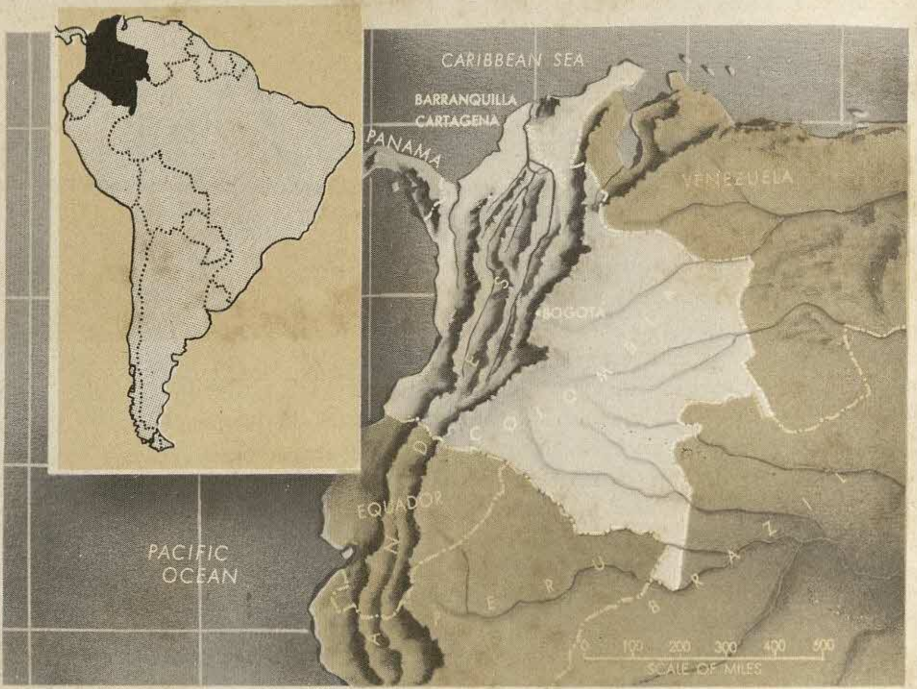
The republic occupies 439,520 square miles in the northwest corner of the continent. Its population is estimated to be more than 13,500,000. The upper classes are of Spanish descent, and Spanish is the prevailing tongue. Over half of the people are of mixed Spanish and Indian blood; less than one tenth of the unmixed Indian race remains. These Indians are descendants of the original inhabitants, a people related to the Incas of Peru.

Topography. In its general character the country is mountainous, being crossed from southwest to northeast by the Andes Mountains. These mountains are united in the southern portion, but in the northern part they divide into three distinct ranges known as the Western, Central, and Eastern Cordilleras. Between the main ranges are many elevated plateaus and cross lines which give the country an appearance not unlike that of Switzerland.

The course of the rivers has been determined by the mountain ranges and they flow mainly in a northerly direction. The Magdalena, the principal river and a commercial highway of Colombia, flows northward between the Eastern and Central ranges, emptying into the Caribbean Sea. It is navigable for more than 900 miles. The valley between the Central and Western Cordilleras is drained by the Cauca River, a tributary of the Magdalena. An extended area east of the Andes contains great forests, or *silvas,* which are now being developed. In the eastern area, also, are extensive pasture lands, or *llanos.*

Climate. Although lying wholly within the torrid zone, Colombia enjoys a considerable variation of climate. Along the coast and in the lowlands the climate is tropical, but in regions of higher altitude it is temperate and healthful. Rainfall is abundant throughout this territory, the amount varying from thirty to forty inches in the eastern section to more than eighty inches along the Pacific coast.

Resources. Agricultural products are the country's chief source of revenue, and



COLOMBIA — GATEWAY TO THE SOUTH AMERICAN CONTINENT
The large map is a close-up of mountainous Colombia and its neighbors; the small map shows its location on the continent.

coffee, from the Andean foothills, is the chief export. Along the coasts, other leading crops are bananas, sugar cane, cotton, rice, fique (hemp), vanilla beans, coconuts, plantains, and cassava. In the higher areas, wheat, corn, barley, potatoes, cacao, and tobacco are grown. Cattle, sheep, goats, and other livestock are extensively raised on the grassy northern plains, or llanos.

From the dense forests of the southeastern plains and mountain slopes come valuable mahogany and cedar, dyewoods, chicle, sarsaparilla, quinine from the bark of cinchona trees, and vegetable-ivory nuts from the tagua palms. Rubber, from both wild and cultivated trees, is important.

The mining of emeralds, gold, and silver, started by the Spaniards four centuries ago, continues. But oil is Colombia's most valuable mineral and, except for coffee, its chief export. Other important minerals include platinum, salt, coal, iron, copper, lead, and manganese.

The chief industrial centers are Medellín, Bogotá, and the Caribbean seaports of Barranquilla and Cartagena. Here foods are processed, minerals are smelted, and steel, wrought iron, textiles, shoes, straw hats, cigars, and beverages are made.

Transportation. Because of the mountains the building of highways and railroads has come slowly. For many, many years, rough mule trails and the rivers were the only means of traveling and carrying goods in Colombia. But a growing network of railroads and improved roads, including the completed 2,300-mile Colombian portion of the Pan-American Highway, is helping to solve the country's transportation problem. However, its network of airways, the largest in South America, is helping even more. Since 1919, when Colombia established the first commercial airline in the Americas, airplanes have linked its cities with one another and with the outside world.

Colombia's principal ports are, on the Caribbean, Puerto Colombia, Cartagena, Santa Marta, Riohacha, and Barranquilla, near the mouth of the Magdalena; and on the Pacific, Buenaventura and Tumaco. The principal exports are coffee, petroleum, platinum, gold, emeralds, cattle, hides, bananas, tagua, Panama hats, rubber and tobacco. Imports include a wide variety of manufactured products.

History and Government. The country now included in Colombia was conquered by the Spanish in the sixteenth century. It was made a Spanish province under the name New Granada, and in 1718 was placed under a viceroy. In 1819, after the successful revolution led by Santander and Bolivar, the name Colombia, in honor of Columbus, was adopted. The present Republic of Colombia was organized under a Constitution adopted in 1886.

In 1903, during the administration of Theodore Roosevelt, the province of Panama formed a separate republic. Subsequently, the United States and Panama negotiated a treaty providing for the completion of the Panama Canal. In 1921 the United States paid Colombia $25,000,000 as part compensation for the withdrawal of Panama, and in 1922 the dispute was officially terminated by a treaty between the two countries.

Colombia has a unitary republican form of government. The President is elected by direct vote for a term of four years, and cannot be re-elected for the immediate succeeding term. He is assisted by his Cabinet ministers. The national legislative body, or Congress, consists of a Senate of sixty-three members and a House of Representatives with 131 members. Senators serve for four years, Representatives for two. The leading political groups are the Conservatives and the Liberals, who were in power from 1930 until 1949, when the Conservatives gained control. In 1953 the Chief of the Armed Forces, also a Conservative, seized the presidency, and the following year he was elected to the office by popular vote. See PANAMA CANAL.

BRAVE CARAVELS WESTWARD BOUND

COLONIES AND COLONIZATION.

When prehistoric man discovered that his family was too large for his cave, he probably started the first colony by giving his strongest son a stone ax and telling him to find a new den of his own. Strictly speaking, a colony is a settlement formed in one country by people from another country, who remain subjects of the original country. From time immemorial man has wandered from overcrowded or unproductive lands toward newer and more attractive fields. Sometimes new hunting grounds, sometimes treasures have beckoned, but man's desire for pioneering has always answered the call of the frontier.

The Early Colonizers. Probably the earliest great colonizers were the Chinese. Hundreds of years before Christ, their great population forced them into surrounding territories until they had penetrated Korea, Tibet, Mongolia, and Manchuria. Later the Greeks and Romans extended their respective colonies until they met, clashed, and merged, leaving Rome supreme from Britain to Africa, where the culture left by her citizens is evident to this day. It was religion that forced the Turks to conquer and colonize in the name of Allah. From the thirteenth to the nineteenth century, great hordes of them poured into Northern Africa and Southern Europe, founding a colonial empire that lasted until the present generation.

The modern wave of colonization began after the discovery of the New World. Adventure, the search for new sea routes, and greed for gold attracted the first explorers. It was much later before they crossed the Atlantic with their families to found permanent new homes.

Spain Forges a Colonial Empire. The voyage of Columbus in 1492 was the beginning of a stampede by European nations to find new realms to conquer and colonize. San Salvador, San Domingo, and other settlements were soon colonies, run by Spanish governors who enslaved and exploited the natives ruthlessly. A greater wave of colonization, however, followed the savage conquests of Mexico and Peru in the sixteenth century. The lure of gold soon brought pirates and adventurers and finally families to all Spanish America under conditions that spelled untold suffering and bloody wars. Under Charles V, Spain ruled more territory than did any other nation—all South America (except Brazil), Mexico, California, and scattered island possessions, including the Philippines.

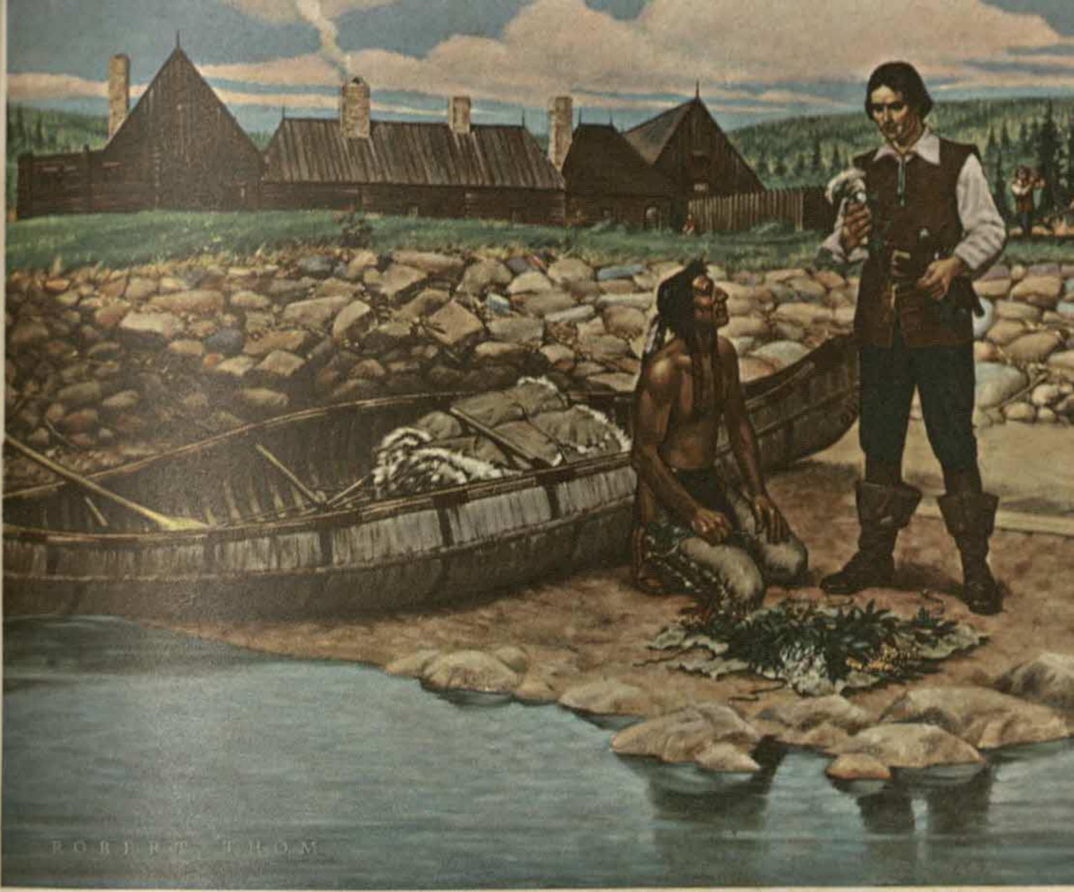
Spanish colonies were managed purely for the benefit of the Mother Country. Enslaved natives worked the rich mines. The earliest towns were founded for the sole purpose of trade with Seville and Cadiz, in Spain, which were given a monopoly of colonial commerce. Only Spanish-born citizens could hold office. When native labor became scarce, Negro slaves were imported in huge numbers. After long wars with England and France, Spanish strength crumbled until Napoleon's conquest of Madrid enabled the Spanish colonies to revolt and become independent.

The United States acquired many remaining Spanish colonies after the Spanish-American War in 1898, and Spain sold the Marianas to Germany. Today Spain holds only a few African possessions and a few island groups. In Latin America, the language and customs of Spain survive as reminders of Spanish America.

The Portuguese as Colonizers. Even before the time of Columbus, the Portuguese were braving the ocean in quest of new lands. Under Henry the Navigator, they began African explorations which were followed by Vasco da Gama, who by 1500 had sailed around the Cape of Good Hope to India. Much earlier, near-by islands, including the Azores and Cape Verde, had been colonized, and Portuguese colonies were established in Ceylon in 1505 and in the Moluccas in 1512. When Brazil was first seen by white men, in 1500, it was claimed by Portugal by right of discovery, and in accordance with the *Bull of Demarcation,* issued by Pope Alexander VI in 1493 (see DEMARCATION, LINE OF). Brazil remained a colony until the Napoleonic wars, when it became an empire. Even today the language there is Portuguese. Portugal still retains vast areas in Africa, including Mozambique and Angola, and has smaller settlements in China, India, and the East Indies.

The Rich Empire of the Netherlands. The Dutch owned one of the most valuable of all colonial empires, which included the fabuously rich East Indies—Java, Sumatra, and part of Borneo and New Guinea—besides islands in the West Indies. This great realm was built up mainly by the Dutch East India Company, which took over the interests of the Netherlands in 1602. Although Holland lost her independence for a time and was forced to cede much territory to Britain, her policy of developing trade with the colonies, rather than enslaving them, has been highly successful. In 1949 sovereignty over most of what had been the Dutch East Indies was transferred to the native state of Indonesia.

The Colossal British Empire. By the 1600's, the British, as other European nations, were taking an interest in the treasures of the East Indies and the West Indies. Private English companies chartered groups of colonists from 1607 on to found colonies in what later became the United States of America. The lure of riches of the Far East led to the founding of outposts in India as early as 1612. Many of the West Indies islands were colonized in the 1600's. In 1763, Great Britain acquired Canada. The



Above, from one of a series of oil paintings, "A History of Pharmacy in Pictures," commissioned by and copyrighted by Parke, Davis & Co.; reproduced by special permission. George A. Bender, project director; Robert A. Thom, artist.

Colonist and Colonized—
Each Learned from the Other

Louis Hebért, a young Paris druggist who came to Port Royal (Nova Scotia, Canada) in 1605, was but one of hundreds of pioneers who gave his talents in exchange for the bounty of the New World. He looked after the health of the settlers, cultivated native drug plants, supervised the gardens, even served for a time as governor of the colony. He later gained fame as Canada's first successful farmer. Many settlers brought the Indians such skills as carpentry, medical knowledge, and farming ability. In return, they learned about such new products as corn and potatoes. Later, the settlers moved on west, laying the foundations for the United States and Canada that we know today.

same war with France that gave her Canada left England dominant in India. In 1783, the American colonists became the first to gain their freedom. Australia became a colony in 1788. In the 1800's, British control in India became stronger and was extended to Ceylon in 1802 and Burma in 1826. Singapore and the Straits Settlements of Malaya became British in 1824 and afterward.

In 1814, the British took over the colony of South Africa from the Dutch, and, in the late 1800's, extended its control over vast parts of Africa. In 1842, the British took over Hong Kong, and soon afterwards established concessions in Shanghai and Weihaiwei in China. Cyprus was taken over in 1878, and Egypt became a protectorate in 1882. Queen Victoria became Empress of India in 1877. Great Britain, in the late 1800's, controlled many Pacific islands. After World War I, German colonies in Africa became English and French mandates. Of Turkish territory, Iraq and Palestine became British mandates. At this time, the British Empire was the world's largest political unit, covering about one fourth of the earth's land area.

Great Britain began granting self-government as early as 1867 when Canada became a dominion. In the same period, Australian colonies received self-government. These colonies federated and became a dominion in 1900. New Zealand became a dominion in 1907; the Union of South Africa in 1910. Provinces in India long had some self-government under their local rulers. Southern Rhodesia got self-government in 1923. The British allowed Egypt to regain control of its affairs in 1922.

Dominions demanded fuller consultation on international affairs that affected them from 1911 on. The dominions and India became members of the League of Nations after World War I. The dominions were recognized as independent nations in the British Commonwealth by the Statute of Westminster of 1931. See BRITISH COMMONWEALTH OF NATIONS.

Most of the British colonies showed the desire for self-government and many for independence. The British began a program of granting greater and greater degrees of self-government. Between World Wars I and II, Iraq, a mandate, became independent (1932). After World War II, many new nations were born of British territory. India and Pakistan became independent in 1947, Israel, Burma, and Ceylon in 1948, Sudan in 1956, Ghana and the Federation of Malaya in 1957, British Somaliland, Cyprus, and Nigeria in 1960. Many British colonies are self-governing, and may become nations of the future.

French Colonial Practice. France, as England, became interested in colonies in the 1600's. Her first overseas colony was Quebec, founded in 1608. Her colonies quickly spread to Nova Scotia, Newfoundland, India, and the Indies. The long struggle with the British in India and America stripped France of all colonies except a few small islands, including Martinique in the West Indies and Pondichéry in India. The eighteenth century, however, saw France again ruthlessly conquer and this time colonize a great empire in Africa and Indo-China. Beginning in 1830 with the snatching of Algeria, France had, by the outbreak of World War II, an empire second in area to the British Empire. It held Morocco, Tunisia, Algeria, French Equatorial Africa, French West Africa, Madagascar, and the mandate Cameroon in Africa. It also held Indo-China, and mandates Lebanon and Syria in Asia. After World War II, France formed the French Union in 1946, and the French Community system in 1958. In the Union, states could become self-governing, and in the Community, nations. By 1960, the greater part of former French colonial territory was occupied by new nations. See AFRICA, *Political Divisions;* ASIA, *Political Divisions;* FRENCH COMMUNITY; FRENCH UNION.

The American Frontier and Colonization. The United States began as a group of colonies, but has herself done much colonizing. By the treaty which gave her independence, the United States was ceded a great wilderness extending to the Mississippi River. Through the purchase of Louisiana in 1803 and later wars and treaties, she extended her boundary to the Pacific. The great task of settling this region has continued until the present time.

The sturdy pioneer first plodded west on foot and in covered wagons and later by train. He was a real colonizer, for he brought with him his family and all his belongings. He built crude houses of log or sod and cleared the forest of timber. He cultivated the soil and fashioned rough clothing for his family. He transformed the frontier into a rich land of cities and industries. His success is due to his unconquerable spirit and the fact that he came to settle and not to conquer.

Other colonial holdings of the United States have been Alaska, bought from Russia in 1867; Puerto Rico, the Philippine Islands, and Guam, acquired after the Spanish-American War in 1898; and Hawaii, annexed in 1898. The Virgin Islands were purchased from Denmark in 1917. The Philippines became independent in 1946, and Alaska and Hawaii became States of the United States in 1959.

Colonies of Other Nations. Argentineans and Brazilians settled many parts of their western frontier in the 1800's. Germany took and lost an African domain between 1880 and 1919. One of Germany's goals in World War II was to gain new territory. Belgium annexed the Belgian Congo in 1908. In 1960, it became the Republic of the Congo. Turkey lost large holdings at the end of World War I.

Italy acquired Eritrea and Italian Somaliland in the 1880's, and Libya in 1912, all in Africa. Mussolini conquered Ethiopia in 1935. Italy lost all these in World War II, except Somaliland, a trusteeship until it became independent in 1960. Japan occupied Formosa in 1895, Korea in 1905, Manchuria in 1931, and added many Pacific islands. It held a vast domain in Asia and the Pacific during World War II. Japan lost all of these holdings at the end of the war. Siberia was a Russian colony from the 1500's until 1922, and is now part of Russia. China annexed Tibet in 1951. See also MANDATE; PROTECTORATE; TRUSTEESHIP.

COLOR, *kul'ur*. The world and life itself would be gray indeed were it not for the beautiful color to be seen in nature and in the handiwork of man. It is impossible to imagine what life would be without the sunset, the brilliant plumage of the birds, the colorful flowers, the stained glass windows in cathedrals and churches, the colors in pictures and in textiles and clothing. The inborn love for color and the ability to satisfy it, afford man one of his greatest pleasures.

The attraction to bright color is one of the first impulses of the child, and brilliant color was one of the first means of personal adornment used by primitive peoples. As man became more civilized and educated, his desire for strong, crude, or intense color in large quantities became less, and colors that were softer made a greater appeal. The proper use of color is, however, but little understood by most persons, and study is necessary for its correct use.

The Science of Color. There is no such thing as color in the sense that we ordinarily think of it. That is, there are no red apples, no yellow squashes and purple grapes, no "glad green miles of tillage," no "Indian corn sprouted from the earth on thin stalks of gold." Color is not a quality of objects; it is an interpretation given to the senses by the delicate functioning of the eye.

The woman who tries to match a colored ribbon at the store takes her selection to the window or steps out of the door. She knows that two pieces which look alike in the artificial light may not match at all when she gets them home. And the traveler whose train carries him through the country at twilight does not report that the sky in Kansas or Ohio is, as he sees it,

> *A line of gold, a shade of withered rose*
> *Amid the gray.*

He knows that in full sunlight the very same sky would be blue.

Whether we see an object as white or black, red or green or any other color, depends on three things: (1) the light it receives; (2) the way it reflects, transmits, or absorbs this light, and the canceling effects produced by interference of light waves; (3) the color sensibility of our eyes.

Light, as explained in the article on that subject, travels in waves. If it vibrates very rapidly, the waves are short; if it vibrates less rapidly, the waves are longer. Some light vibrates so rapidly we do not see it,

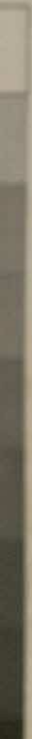
George C. Hight, from Sun Oil Company

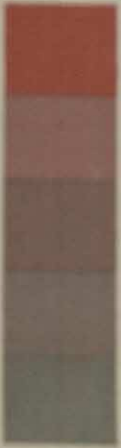
THE DIFFERENCES OF COLOR THAT HUMANS SEE

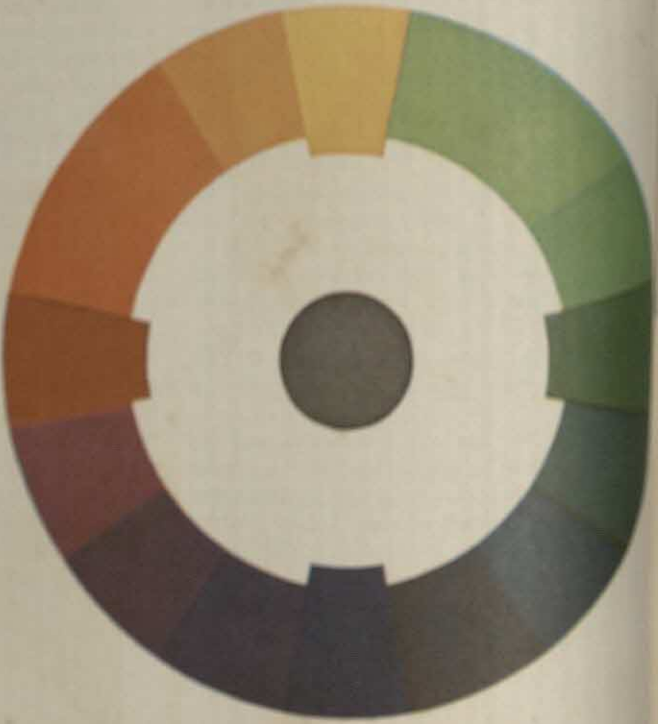
■ We see differences of brightness. This scale from black to white shows some of the values we see.

■ Below is a scale of saturation or intensity that we see in the hue of red.

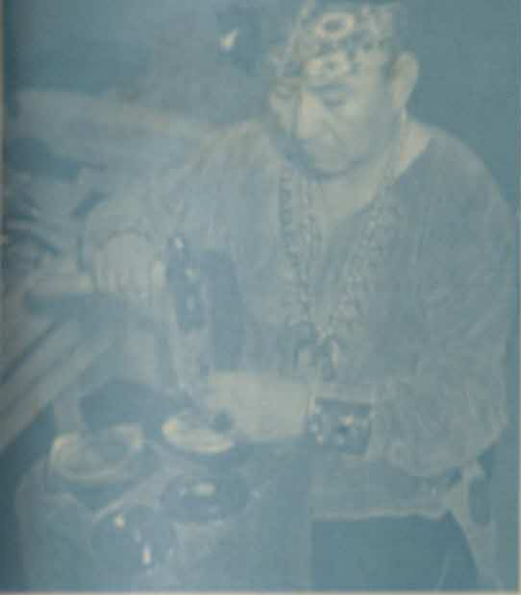
■ Contrasting hues are set across the circle from one another.

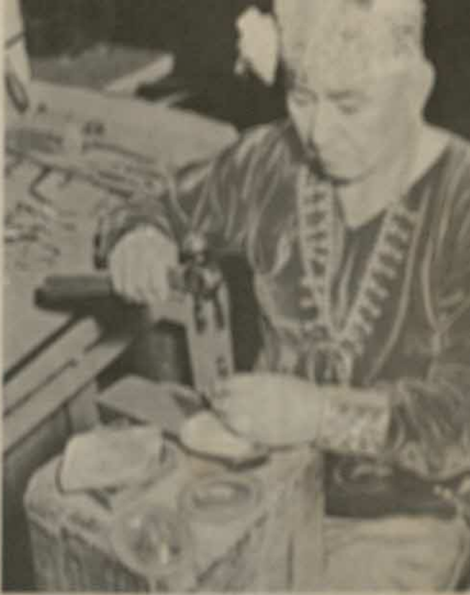






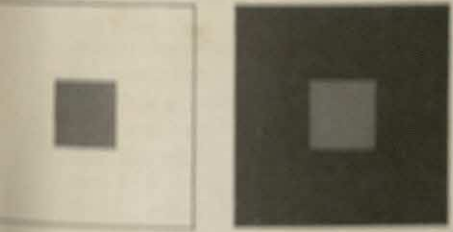
Frederick J. Drake & Co.





HOW TO USE COLOR CONTRASTS

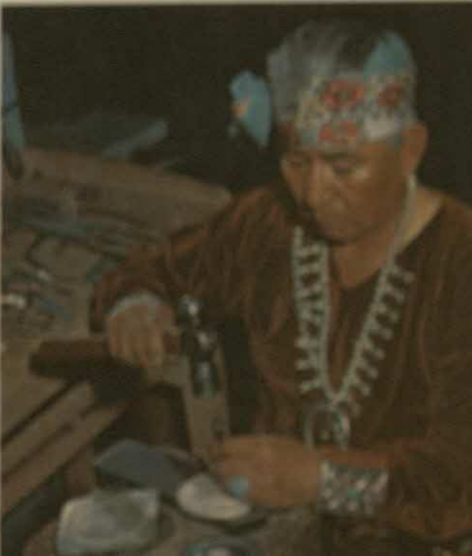
Below is a demonstration of the way color differences affect what we see. Two samples of the same color (physically speaking) are presented against colors that are very different in brightness, a white and a black. As a result, the samples appear different. The middle valued



grey is different from the white in that it is darker, and so it appears. The same grey is different from black in that it is lighter, and that is what we see. Generally, all the color differences operate to create similar responses. A red hue may be seen more or less red by what it is different to in amounts of red. A red hue may be seen more yellow or more blue by what difference it has in hue to the adjacent colors. The psychological color wheel on the opposite page illustrates these differences of hues in complementary pairs across the circle.

HOW TO MAKE DIFFERENT COLORS

The plates of the Navaho silversmith show how the printer uses three hues, black, and the white of the paper to make many different colors. Making different colors with paint may be done in the same manner. The reproduction of the metal jewelry illustrates (1) how the artist or printer has to use psychology to find out that people do not see a metal color, but rather the way the metal affects colors, and (2) how artists and printers use physics to make the color they wish people to see.



although it can be photographed. Some vibrates so slowly we do not see it.

The longest waves which affect our eye are those which give us the sensation we call red: they are .00003 inches, or three-hundred thousandths of an inch, in length. The shortest we can see give us the sensation of violet; these are somewhat more than half as long (.000016 inches) The still shorter waves contain the invisible ultra-violet rays sometimes used in medical practice; those too long to be seen are infra-red. The above measurements refer to the standard red and violet. The more yellow the red, the shorter the wave length.

The light of the sun contains waves of an infinite number of different lengths and gives us the sensation we call white light. Visible white light is a combination of the seven colors of the rainbow—violet, indigo, blue, green, yellow, orange, red. The light of a kerosene lamp has fewer blue waves than sunlight, and objects which in sunlight we call blue seem less blue by such lamplight. Similarly, the light from a Welsbach gas mantle is deficient in long rays, and that from a mercury lamp (such as printers sometimes use in the composing room) has practically no long rays. Nothing can look red in this light, and people upon whom it falls seem a ghastly green.

How an Object "Takes" Color. If sunlight falls upon snow, waves of every length are reflected, and we say the snow is white. If the light falls on a "red" tulip, only the longest waves may be reflected, and the tulip seems red. The orange reflects waves that are not quite so long, the lemon those that are even shorter, and the growing leaf, the sunlit sky, and the violet those shorter and shorter still. Each object, therefore, acts differently in response to light. If it reflects no light at all, it is black. Pigments thus are classified by their ability to absorb all the waves of white light except those they reflect.

If a substance is transparent, it is not the light it reflects, but that which passes through it that impresses us. When seen through smoked glasses, the world seems to be made up of various shades of yellow and black. The reason is that the glass turns back practically all waves except those of the length which gives us the sensation yellow. Photographers use red glass in the window of a dark room because it admits only the long rays, and these do not affect the photographic plate.

To repeat, rays that are neither reflected nor transmitted by an object must be absorbed. Here we have the reason why some colors of clothing are cooler than others. White cloth reflects all rays, black cloth none. Since the absorbed light becomes heat, black cloth is warmer than white cloth.

Qualities of Color. The three qualities, or "dimensions," of color are hue, value, and chroma, to be used in exact color determinations.

Hue is the quality by which one color is distinguished from another, as red, yellow, or blue.

Value is the light or dark quality of a color, or the quality by which a light color is distinguished from a dark one. A light value of a hue is called a *tint;* a dark value, a *shade.*

Chroma is the strength of a color, or the quality by which a strong color is distinguished from a weak one, or a bright color from one that is grayed.

Warm colors are red, yellow-red, yellow, and their intermediates—the colors that fall between them. These colors absorb the light and have the quality of nearness. They suggest the warm element of the sun and fire. Cold colors are blue, green, and purple and their intermediate colors. These colors reflect light, have the quality of distance, and suggest the cooler elements of distant trees, foliage, shadows, water, and sky.

Use of Color. A knowledge of how to use and combine colors effectively is very much to be desired in furnishing and decorating a home. Dark colors decrease the apparent size of a room, while light colors make a room appear larger. Dark colors also absorb so much light that they are not economical from the standpoint of getting the entire advantage of artificial lighting.

The exposure of the room determines to a certain degree the color chosen. Cool colors, such as blue, violet, blue-green, or slate-grays, are not pleasing as backgrounds in small rooms, since they lack warmth. If a room has a south exposure, with plenty of sunlight, a soft gray, a very light gray-green, a putty color, a cream, or old ivory will make the room appear cooler, while for a north room light yellow, buff, a grayed yellow, or a grayed yellow-orange of a light value will be better, since these colors appear to bring warmth and sunlight. Ceilings are usually finished in cream or in a lighter tint of the wall decoration.

Nature's Colors and Harmonies. There is no finer instructor in color than Nature. Outdoors, the cooler colors, such as green, blue, and purple, violet-grays and neutral grays, tan and soft brown, predominate. Warm colors, such as intense red, are seen in smaller amounts than the cooler hues. The red of a bed of geraniums, for example, is small in area in proportion to the large mass of green foliage and the surrounding grass and trees. In the autumn, the strongest chroma, or greatest intensity and brightness of color, is found in the gold, red, orange, and bronze coloring of the trees. The climax of color in the entire year is then reached. The sky appears more blue than before because of its contrast with the golden-orange of the trees.

In the spring, the different hues of green, such as yellow-green and blue-green, as seen in the new leaves and grass, form beautiful self-tone harmonies. As the autumn forms the color accent of the year, so the sunset forms the accent of the day. The earth is enveloped in blues, grays, and purples, the values often ranging from light grays to darker grays, and from dark values to almost black.

As one faces the sunset, the green of the grass and the hills seems to have disappeared or to be gray, but if one turns away from the sunset, the grass appears to be green again. The sunset is frequently very brilliant at first, but gradually the colors soften and spread over the sky, until, finally, but a few clouds remain, and the color gradually dies away.

Nature shows a gradual change from season to season, from day to night, and there is order and unity in the whole. The sunset comes at the close of day, when work is almost done, and by its compelling beauty, lifts the eyes of men from the earth to the heavens. The moon and planets and myriads of stars light the earth with a silvery sheen and tip the ocean waves with gold. At every hour of the day, at every season of the year, beautiful, colorful, and ever-changing canvases are spread before those who have eyes to see and appreciate. See LIGHT.

COLORADO'S CLASSIC CAPITOL
Built of granite, the structure forms an almost perfect Greek cross. Its dome commands a sweeping view of snow-covered peaks.

COLORA'DO. Just a hundred years after the signing of the Declaration of Independence, Colorado was admitted into the Union. For that reason it is often referred to as "the Centennial State." Bounded by Wyoming, Nebraska, Kansas, New Mexico, and Utah, Colorado is not the "far west" state that many people imagine it to be. Indeed, the eastern boundary lies only 200 miles west of the geographical center of the United States. Colorado is a big state, with an area of 104,247 square miles. Colorado is larger than all the New England States and Indiana combined, is

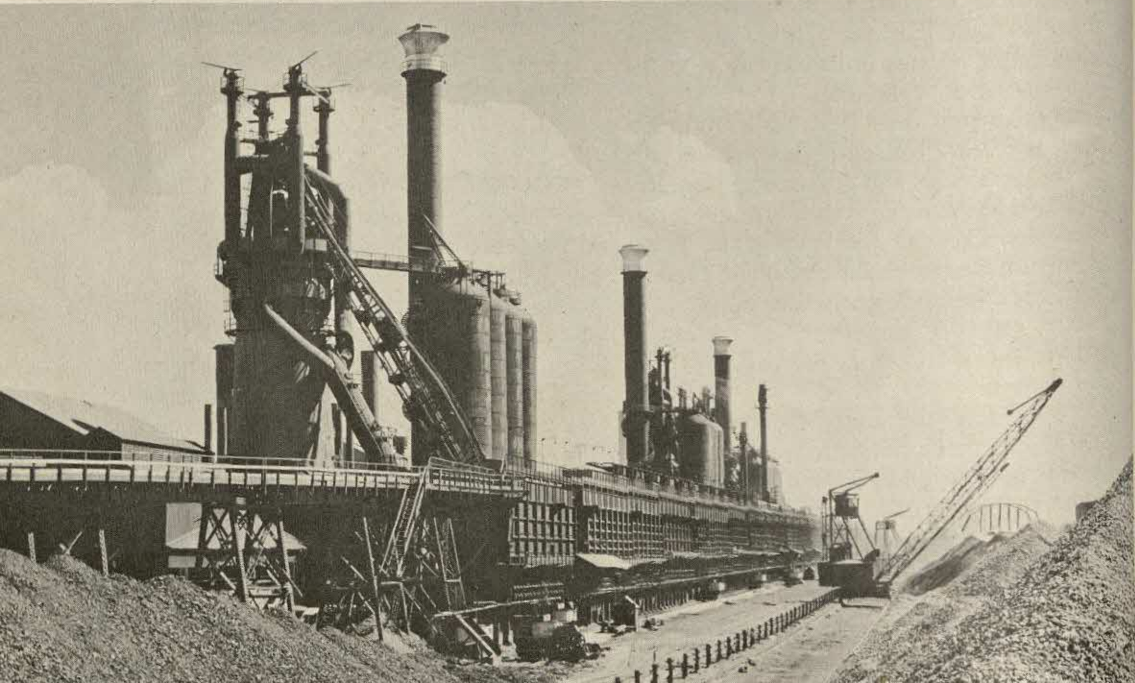
Berko; Colorado Fuel and Iron Corp.

CULTURAL CENTER IN THE MOUNTAINS

Musical, literary, and other cultural events of international importance are held at Aspen.

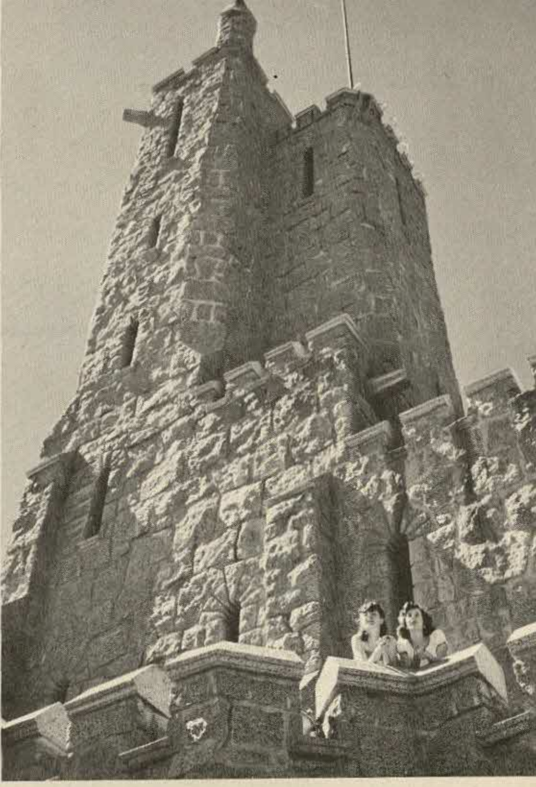
WHERE ORES BECOME METALS

Smelting of ores from Colorado's many mines is one of the state's leading industries. Below is shown a row of huge blast furnaces at an iron and steel plant in Pueblo.



twice as large as England, and is equal to Italy in size.

In the Heart of the Rockies. Although Colorado is famous for its mountains and peaks, it is divided into three general areas. In the eastern half of the state great rolling plains slope up to the foothills of the Rockies. These plains, varying in height from 4,000 to 6,000 feet, form the farming area of the state. Through the heart of the state rise the lordly Rockies with their many lofty peaks and breath-taking scenery. Of the many towering peaks in the state, about 1,500 are over 10,000 feet high. Of these, more than fifty have altitudes over 14,000 feet. The two highest are Mount Elbert (14,431 feet) and Mount Harvard (14,420 feet). Of peaks of the United States, these peaks rank in height after several in Alaska and Mount Whitney in California. The most famous peak in Colorado is Pike's Peak (14,110 feet).



State of Colorado Advertising and Publicity Department

A STATE WITH MUCH TO SHOW VISITORS

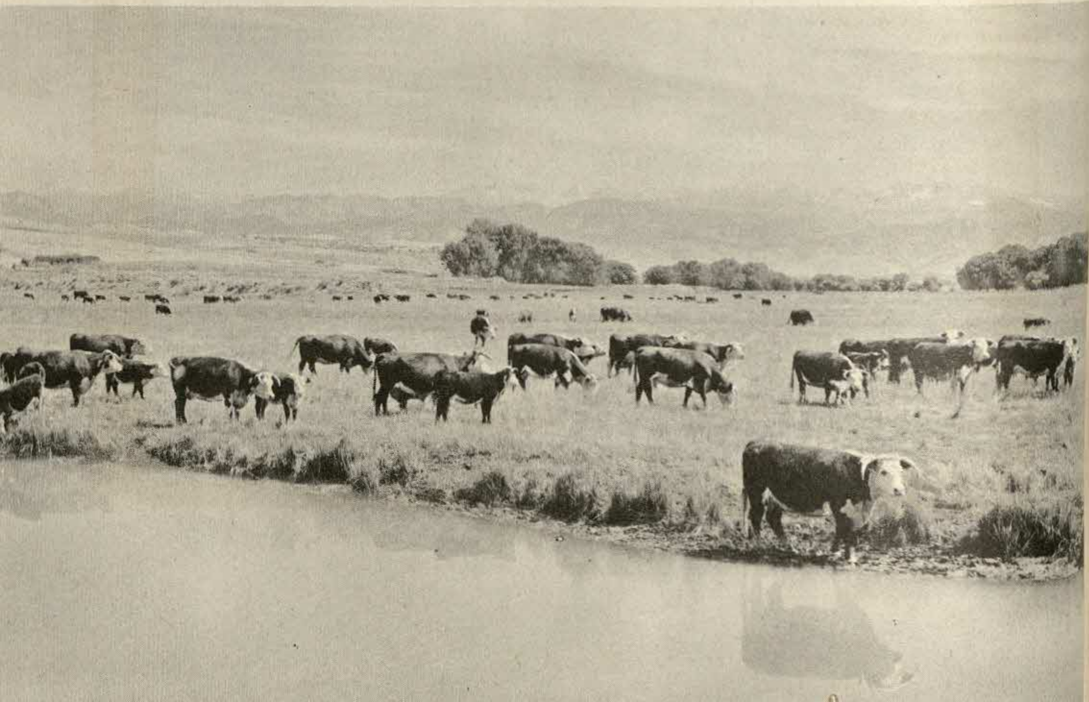
One of Colorado's outstanding tourist attractions is the Shrine of the Sun, top right, a memorial to Will Rogers, which stands on Cheyenne Mountain. Above is an aerial photograph of the center of Denver, the state capital, situated a mile above sea level.

Union Pacific Railroad Photo

SHEEP, CATTLE AT HOME ON THE RANGE

The grassy plateaus and mountain valleys of Colorado support huge numbers of sheep and cattle. Ordinarily there are about two million sheep and two and a half million cattle being raised in the state. Above, a flock of sheep grazes near Walden, guarded by two herders and their dogs. In Colorado, sheep are raised chiefly for their wool. Sheep can thrive on land where the grass is rather sparse, while cattle require a thicker growth. Below, a fine herd of beef cattle ranges over a stretch of well-watered grassland near Boulder. The sale of livestock and livestock products accounts for more than half of Colorado's agricultural income.

Colorado Department of Public Relations

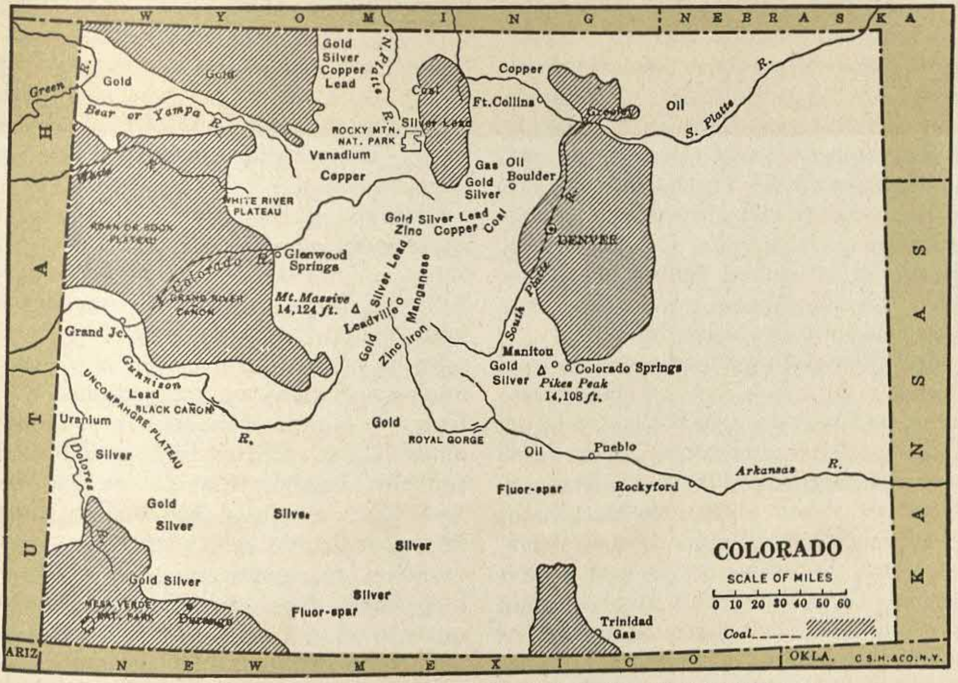


Between the ranges of these mountains are a number of fine parks, called the Rocky Mountain Parks. Rolling grasslands and rock formations are the attractions there, and not many trees will be seen. The largest of these parks, San Luis Park, is about the size of Massachusetts; the smallest, North Park, is almost as large as Rhode Island. It is interesting to note that these parks are among the highest in the world, about one and one-half miles above sea level. Colorado also has Rocky Mountain National Park and Mesa Verde National Park.

The third division of the state is an enormous plateau along the western edge of Colorado. This plateau, though rugged, forms a valuable grazing area and is nowhere less than a mile above sea level.

Rivers. Few states can boast the number of rivers found in Colorado. Springing up in the great central mountain section of the state, these rivers, formed by melting snow and ice, rush down to the valleys and are of little use for navigation. Fine fishing is to be found in them, however, and trout fishing in the mountains is one of the attractions of the state. Among the rivers rising in Colorado are the South Platte, the Arkansas, the Rio Grande, and the Colorado.

Climate. Whatever type of climate the visitor seeks, he can find in Colorado. For here, due to great variations in altitude, climate may vary from dry to rainy, from chilly to very warm. In fact, the United States Weather Bureau divides the state into five weather zones, the mean average temperature varying from 35° or less on the mountains to 50° or higher in many of the valleys. The air is dry, thin, and invigorating. There is always an abundance of sunshine, an average year having 300 days of sunshine. Fog is practically unknown, except occasionally in the eastern parts. In the summer the sun is hot, but never oppressive, as in the Corn Belt. Because of the unusual climate, a number of tuberculosis sanitariums have been established in Colorado, the thin, dry air being considered a



INFINITE RICHES LIE BENEATH COLORADO'S ROCKY SOIL

Much of America's silver and many other metals come from this mountain state. In spite of the incredibly rough country, hardy miners have sunk many shafts.

General Electric

ON TOP OF THE WORLD IN COLORADO

Vacationers debark from a sightseeing car on the world's highest cog railway at the summit of Pike's Peak, one of the giants of the Front Range of the Rockies. Powerful 450-hp diesel-electric locomotives supply the power for the long, scenic climb to the 14,000-foot level. The locomotive pushs the car up, precedes it to give braking action on the way down.

very great aid to recovery from this disease.

A Hunter's Paradise. Few spots on the North American continent offer such possibilities for big-game hunters as Colorado offers. In the region of the Continental Divide and the great parks, grizzly, black, and brown bears thrive. The hunter may also come upon deer, elk, and antelope, as well as smaller game animals. Combined with the almost unequaled fishing in the icy rivers, this abundance of game makes Colorado a vacation spot second to none.

Agriculture. In spite of the mountainous character of the state, there are about 45,600 farms in Colorado, which has a total of about 38,000,000 acres in farm lands. Most of this acreage is used in raising livestock. Crops are raised in the eastern section, where much land is under constant irrigation, and the remainder is mostly dry-farmed. Corn, barley, oats, and wheat are raised, in addition to great quantities of alfalfa, potatoes, and sugar beets. The state is a leader in sugar-beet production, with a huge annual crop. Fruit raising is also an important industry, especially on the western slopes. Among the outstanding fruit crops are apples, peaches, and cherries. Cattle, horses, and sheep form a great part of the state's wealth, the wool clip alone amounting to about 10,000,000 pounds annually. Dairying and poultry raising are large industries.

Minerals. Ranking with agriculture as a source of Colorado's income, minerals of almost unlimited variety are to be found. Although it was known at the time of the Louisiana Purchase that this area possessed a wealth of precious minerals, no definite mining operations were started until 1858. Later, the income of the state from various minerals was often as high as $5,000,000 annually. Leading minerals are gold, silver, copper, zinc, and lead, and there are important yields of molybdenum, uranium, vanadium, manganese, tungsten, and fluorspar. Many types of building stone are quarried in the state. Tremendous coal fields are to be found in Colorado, with coal mines in sixteen counties. Oil, gas, and mineral springs are also exceedingly important.

Manufacturing. In spite of the fact that Colorado has a population of only 1,753,000, manufacturing is one of its greatest activities. Lying in the midst of one of the richest agricultural and mining areas in the United States, Colorado has factories turning out a great variety of finished goods with great value. Sugar refining, meat packing, flour milling, canning, and iron manufacture lead in importance. Rubber goods, bricks, soap, and automobile supplies are also produced.

The present output of manufactures is only a beginning, for Colorado is richly endowed with cheap water power and an unlimited supply of coal. Add to this the 4,300 miles of railroads, the 26,000 miles of fine highways, and modern air transportation, and it will be seen that Colorado has a definite competitive advantage over other states.

Unparalleled Scenic Grandeur. So many unusual natural wonders are found in Colorado that the traveler scarcely knows where to start. The awe-inspiring Garden of the Gods, lofty Grand Lake at an altitude of 8,369 feet, the Rocky Mountain National Park, Pike's Peak, the Cave of the Winds, the Black Canyon of the Gunnison, and the Royal Gorge of the Arkansas hold the traveler in their unforgettable glory. Many of these scenic spots may be viewed from the comfort of Colorado's well-equipped railroads.

A Young State. Although Colorado was explored by the Spaniards in the sixteenth century, it was not until after the Louisiana Purchase of 1803 that any serious attempt at settlement was made by pioneers. Named after the Colorado River, signifying "red," Colorado was visited by Zebulon Pike in 1806 and by Fremont in 1843. Following the discovery of gold in 1858, Denver and Boulder sprang into being as mining settlements. In 1861 Colorado became a territory, carved out of portions of Kansas, Nebraska, New Mexico, and Utah. It was admitted to the Union in 1876.

Government and Education. Colorado has a senate whose members are elected to serve four years, a house of representatives whose members serve two years, and a governor elected for a two-year term. A supreme court of one chief justice and six associate justices rules on cases appealed from lower courts. Modern laws and statutes have made Colorado outstanding in legal development. In 1893 woman suffrage was granted, Colorado being the second state to allow this privilege. The recall, life imprisonment for kidnapping, old-age pensions, strict regulation of liquor, and anti-trust laws are other examples of intelligent legislation.

The University of Denver was the pioneer institution of higher learning and was opened under the name of Colorado Seminary in 1864. Numerous teachers' colleges, a school of mines, and a fine agricultural college are among the state's outstanding educational institutions.

Consult the following titles for additional information:

Garden of the Gods
Denver
Parks, National
Pike's Peak
Rocky Mountains

COLORADO RIVER. From its source in Northern Colorado, this most fascinating of American rivers flows swiftly through mountainous Western Colorado into Eastern Utah. In the southeastern corner of Utah it is joined by the Green River, a large tributary rising near the Shoshone Indian Reservation in Western Wyoming and flowing in a southerly direction to the junction of the two streams. From this point, the Colorado continues its southwesterly course across the Arizona line to a spot where, joined by the Little Colorado, it cuts sharply westward and flows through the fairyland that is Grand Canyon National Park.

Continuing westward, it suddenly turns southward, forming the boundary between California and Nevada on the west and Arizona on the east. Then, following a wandering course southward, the river empties into the Gulf of California, in Mexico. From the source of the Green River to the mouth of the Colorado, the

Union Pacific Railroad

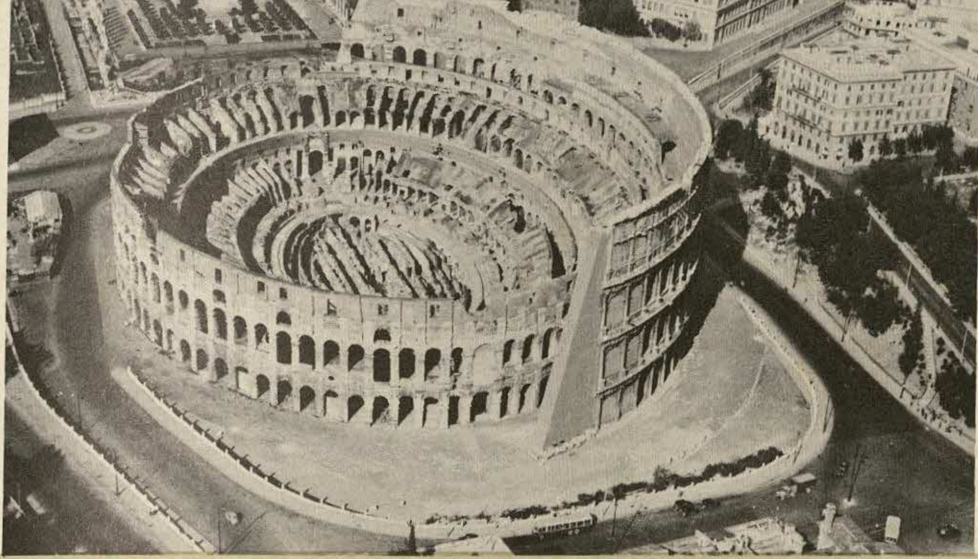
COLORFUL CANYON MILLIONS OF YEARS IN THE MAKING

The Grand Canyon of the Colorado River in Arizona was carved from solid rock by centuries of raging torrents. The canyon is more than a mile deep, four to eighteen miles wide, and about 217 miles long. It was discovered by the Spaniard Cardenas about 1540.

turbulent waters have traveled a distance of over 2,000 miles.

Nature's Greatest Wonder. In Northern Arizona is the world's most sublime scenic spectacle. For 200 miles, after being joined by the Little Colorado, the Colorado River flows through a chasm of unbelievable extent and beauty. Rocky cliffs tower fully a mile over the boiling, seething torrent. Sometimes vertically, sometimes in colorful terraces, these rocky walls descend to the water's edge. The stream itself varies in width from 30 to more than 300 feet, and drops from 2 to 200 feet a mile; its surface is chopped by innumerable rapids and waterfalls. Of such rare beauty is the gorge cut by this river that the United States Government has set it aside as a National Park (see GRAND CANYON OF THE COLORADO). Further down its course, the stream again cuts through rocky chasms some 7,000 feet deep, but the most beautiful section lies within the limits of the park. Regular mule trails are established, so that travelers may ride to the bottom of the chasm. At the top, the width, in some places, is in excess of fifteen miles.

On the Nevada-Arizona boundary is a great dam that harnesses the Colorado River and provides water for generating electrical power and for irrigation. See BOULDER DAM.



Italian State Tourist Office

RUINS OF THE LARGEST ROMAN AMPHITHEATER

The Colosseum, which fell into ruins after the sixth century, has been the scene of modern plays on a specially built temporary stage.

COLOSSEUM, *kol o se'um.* Scene of gladiator contests, naval combats, and martyrdom of early Christians, the Colosseum stands in ruins today—a memorial to the colorful and dramatic days of Rome's bravery and brutality, courage and cruelty.

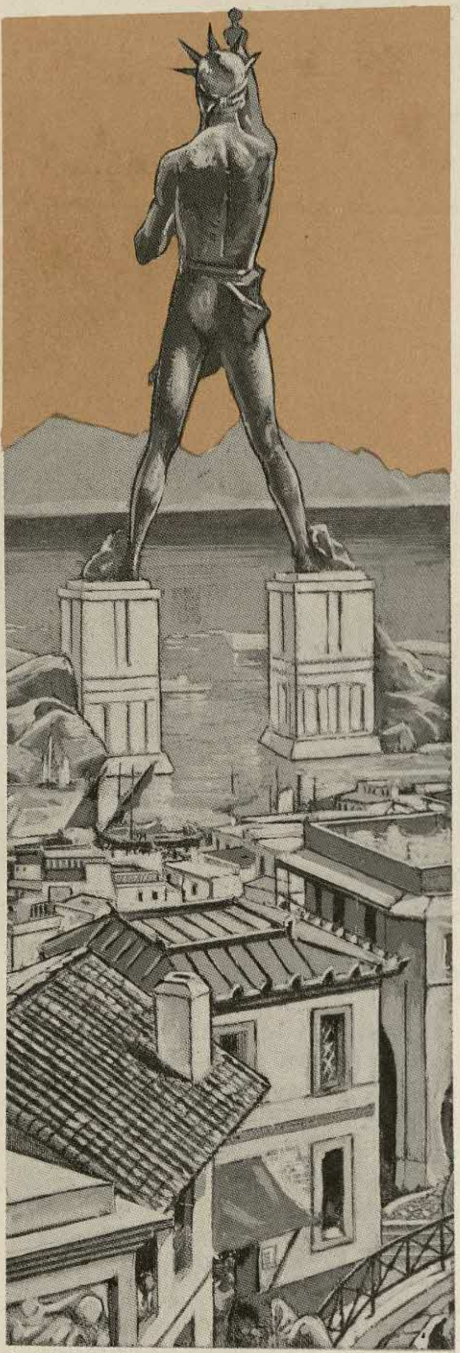
The largest of all ancient amphitheaters, the Colosseum is an oval 617 feet long, 512 feet wide, enclosing an arena 281 feet by 177 feet. Rising to a height of 159 feet, it is four stories high. It had seats and standing room for over 80,000 spectators. The first three stories are vaulted arches between which semi-arches are used for decoration. The fourth story, which is higher than the others, is a wall broken by windows, smaller openings, and pilasters. Beneath the arena, which could be flooded for naval displays, were cages for animals and quarters for men; there was also an arrangement of awnings which shaded the spectators, and, it is thought, the arena. The four stories are intact only on one side.

The Colosseum, or Flavian Amphitheater, as it is sometimes called, was begun by the Emperor Vespasian in A. D. 75, and completed five years later by his son, Titus. The name Colosseum was taken from the colossal statue of Nero, which was near by.

COLOSSUS, *ko los'sus.* Any statue of gigantic size, such as the *Statue of Liberty* in New York, is called a colossus. The Egyptians produced many of these huge statues, chiefly in connection with their temples. But the finest of all colossi were those of the Greeks. The most famous was the 100-foot bronze *Colossus of Rhodes,* by Chares of Lindus. Representing Helios, god of the sun, it was one of the Seven Wonders of the Ancient World. It was supposed to have straddled the harbor of Rhodes, and it was said ships could pass between its legs.

Other Greek colossi include the bronze statue of Athena on the Acropolis at Athens, the gold and ivory Athena in the Parthenon, and the Olympian Zeus, sculptured by Phidias, greatest of Greek sculptors. The Romans had huge figures, such as the statue of Jupiter in Rome and the figure of Nero, 110 feet high, which stood not far from the Colosseum. Modern colossi include the *Germania* at Niederwald on the Rhine, the *Great Buddha* in Japan, *Christ of the Andes,* and *Black Hawk,* near Oregon, Ill.

COLUM'BIA, S. C. Capital of the state and county seat of Richland County, Columbia is situated almost in the middle of South Carolina. An industrial city, it is surrounded by cotton country and is the most important cotton-manufacturing cen-



A WONDER OF THE ANCIENT WORLD

The huge bronze figure known as the Colossus of Rhodes, which towered above the ancient city. For sixty years a beacon to ships of the Aegean, this landmark was destroyed by an earthquake.

ter in the state. Other industrial products include lumber, fertilizer, machinery, iron goods, and cottonseed oil. Columbia has been the state capital since 1786. The population is about 100,000.

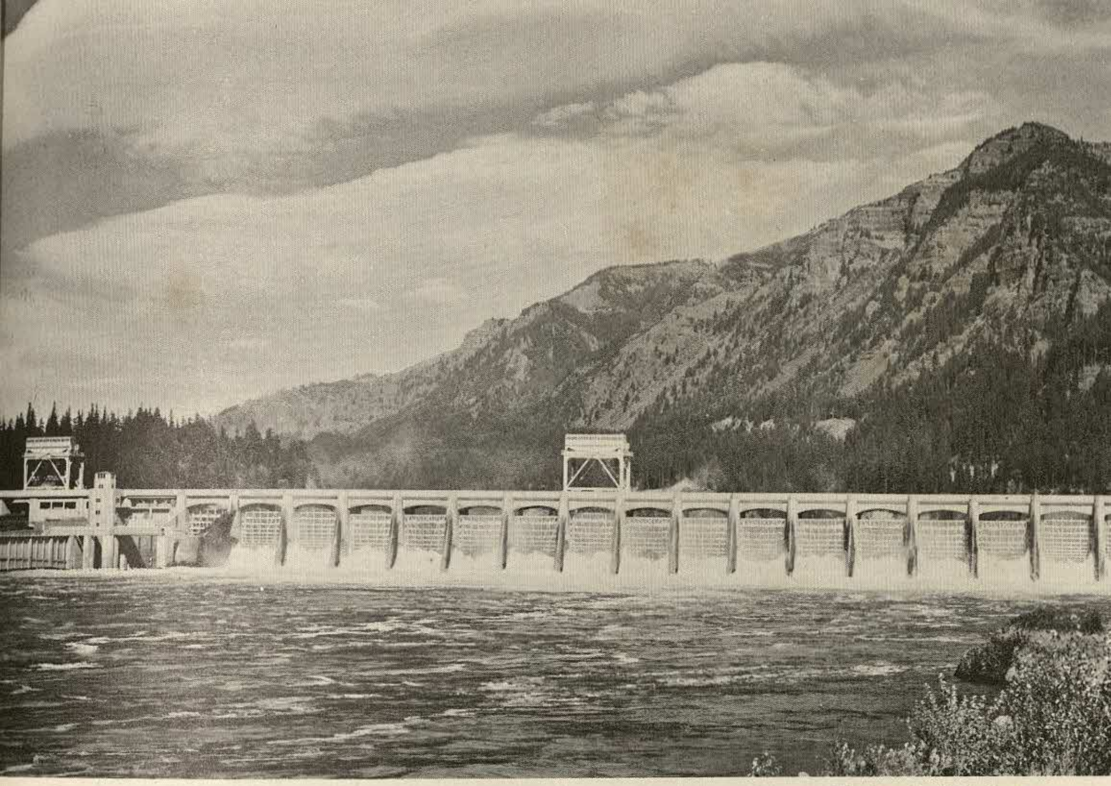
The University of South Carolina is in Columbia. Other educational institutions are Columbia College for women, Columbia Bible College, Lutheran Theological Seminary, and Benedict College and Allen University for Negroes. Thus, the city is an important cultural center for a large area. It is also the site of the state penitentiary and state insane asylum.

During the Civil War, Sherman occupied Columbia on February 17, 1865. That night a disastrous fire, thought to have been accidental, almost destroyed the city. However, the city was rebuilt and today has a beautiful residential section and a fine business district.

COLUMBIA RIVER. Southward through the state of Washington, and westward between Washington and Oregon, rushes the Columbia River, a fast-moving, powerful stream of water that holds within its 1,400-mile course the future of the Northwest United States. Today this river is important mainly for its salmon fisheries and rugged beauty, but within the next fifty years it may be the backbone of a prosperous industrial and agricultural region.

Ever since Lewis and Clark explored it in 1804, men have made use of this river. From the standpoint of its fisheries, it has been the most productive stream in the United States. Every spring, millions of pounds of salmon are caught, and the salmon canning factories on its banks have provided employment for thousands. It also has been used to some extent for navigation, principally in its lower reaches, where it empties into the Pacific Ocean. Over a part of its course there is some of the finest scenery in the world, and to this region of beauty come many tourists every year.

A splendid motor highway follows the river for 500 miles. Extending west from Portland to Seaside on the Pacific and east



Northern Pacific Railway

POWER AND BEAUTY

The swiftly flowing Columbia River turns many a mighty turbine. Bonneville Dam, framed by the Cascade Mountains east of Portland, Oregon, was completed in 1937. It is the world's largest set of lift-locks. The splendor of this man-made structure, surrounded by the natural beauty of the river and the mountains, is a sight that travelers can enjoy from a train window.

from Portland to Pendleton, the Columbia River Highway traverses a region of varied and inspiring scenic wonders. Mountains, valleys, steep cliffs, tumbling waterfalls, glorious views, color—all are there to delight and awe the visitor.

A River of Destiny. In recent years, however, the Columbia River has become more than a salmon stream and a tourist's paradise. It is today the center of the greatest construction program ever contemplated in, or by, the United States. This project consists of a series of great dams, costing hundreds of millions of dollars. They are designed to harness the tremendous energy of the river for the production of electrical power sufficient to run the machines of a great industrial region, and to irrigate an area larger than Rhode Island and Delaware combined. The first dam to be finished was that at Rock Island, near Wenatchee, Wash. The Bonneville Dam, with the world's largest set of lift-locks, was completed in 1937. The Grand Coulee Dam, part of the Columbia River Basin project, was completed in 1941, two years ahead of schedule.

This great program is possible because of the nature of the river. It differs from most streams in the United States. During the summer, the river is high when other streams are low or dry, providing water for irrigation when it is needed most. This condition exists because the glaciers of the Canadian Rockies, where the Columbia has its source, melt fastest in late spring. These glaciers contribute a large amount of water, and, combined with the contributions of the Clark Fork, Spokane, and Snake rivers, give the Columbia a constant flow the year around. In addition, the river slopes nearly 3,000 feet from its source to the mouth, and this steep grade makes it the leading stream in the country as a source of electric power for industries.

The Grand Coulee project is located on the river about ninety-five miles directly south of the Canadian border. The river there turns north before twisting west and south, and in this section is known as the Big Bend. Long ago, a glacier dammed the river at this point, forcing it to seek another course higher up. Accordingly, it cut a gorge fifty-two miles long and from two to ten miles wide, in the soft rock above its bed. But, when the glaciers melted, the river dropped to its normal course and this large canyon was left high above the river bed. Known as the Grand Coulee, the canyon formed a natural reservoir for storing water, once the dam was built.

South of the Grand Coulee is the Columbia River Basin, with an area of 2,500,000 acres of flat land that once was farmed, but became arid and desolate. The project first dammed the river, then pumped the water into the Grand Coulee where it was stored, and then, by a system of canals, planned the draining of the stored water into the Columbia Basin, thus providing good farm land for thousands of families.

The Grand Coulee Dam itself was the largest in the world when finished in 1941. The foundations were begun in 1934. The completed dam is 4,300 feet long, longer than three Empire State buildings laid end to end; 560 feet high, or as tall as the Civic Opera House Building in Chicago; and 500 feet thick at the bedrock base. It contains 11,250,000 cubic yards of concrete, and is three times as large as the Great Pyramid in Egypt.

Within seven months from the completion of the dam, the lake forming behind the great wall had reached the Canadian border, 151 miles away, and was recognized as the largest manmade lake in the world. Its capacity of eight hundred billion gallons of water equals about 2,000 gallons for every person on earth. Each of the twin power houses produces as much electricity as Muscle Shoals and the great dam over the Dnieper River, destroyed by the Russians in World War II and then rebuilt.

Bonneville Dam, described under its title in this work, is located forty-two miles east of Portland, Ore., on the stretch of the river that separates Oregon from Washington. An unusual feature of Bonneville Dam, and of the one at Rock Island, is a system of fish elevators which permit the salmon to ascend the river over the dam.

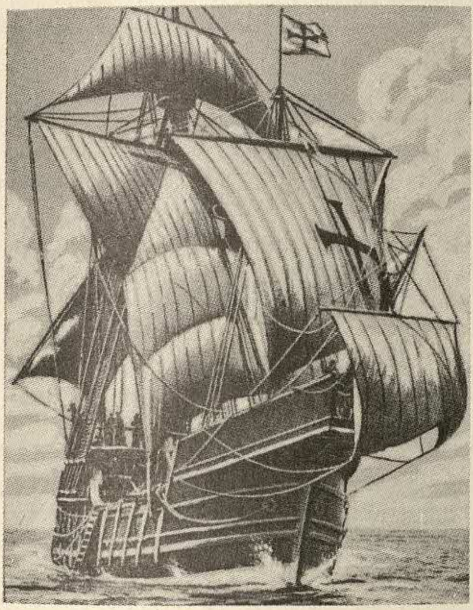
Grand Coulee's power production has been steadily increased by the addition of generators, and the over-all development of the Columbia Basin has had far-reaching effects throughout the Northwest. The industrial possibilities opened up by the cheap electrical power made available have brought about a great increase in population, with workers and their families moving into the area from distant parts of the nation. The states served by the power have taken on new importance as producers of light-metal goods and other products, and the ever-growing regions under irrigation yield excellent crops. While planning and construction continue, the Columbia has already proved itself to be a river of destiny. See IRRIGATION.

ROCKY MOUNTAIN DAINTINESS
The columbine—state flower of Colorado.

COL'UMBINE. The wild and cultivated flowers we call the columbines belong to the same family as the larkspurs and buttercups. Columbines have oddly shaped blossoms that have been compared to the cap of a court jester or the talons of an eagle. The wild scarlet and yellow columbine is found throughout most of the United

States and Southern Canada, while a native blue species is the state flower of Colorado. Wild columbines grow upon rocks, from which they seem to draw water.

The cultivated columbine is a dainty plant that fits into a garden in a hundred places. It has a host of colors—red and yellow, blue and white, pink and white, pure white, clear sulphur-yellow, deep purple, and many other combinations. Some flowers have very long spurs and others are spurless; some are single and others double.



DISCOVERER OF A NEW WORLD
Christopher Columbus sailed west in the *Santa Maria* to find Asia, and prove the world round. Instead of reaching Asia, he changed the course of history by discovering America.

COLUM'BUS, CHRISTOPHER (1451?-1506). On August 3, 1492, three little ships sailed out of the harbor of Palos, Spain. To most of the people of Spain, they were boats manned by criminals and led by a lunatic who claimed the world was round. But to history, they were ships of destiny, sailing on the greatest voyage of all time and captained by a man whose name was to be honored throughout the ages. For these three ships, the *Nina,* the *Pinta,* and the *Santa Maria,* reached land by sailing west across the Atlantic! And their captain, Christopher Columbus, discovered a New World—a land that was to affect the fortunes of men and nations for centuries to come.

Christopher Columbus, the Genoese map maker, never knew that he had discovered a new land. He never knew that his voyage opened an era that was to change the course of the world. All that he had sought to do was find a new route to the rich and faraway Indies, which had been cut off from Europe by the capture of Constantinople in 1453. In fact, when his epoch-making voyage was completed, he thought he had reached the Indies. Little did he know that the land he was seeking was thousands of miles farther on.

The Young Columbus. Few facts are known about the early life of the man who was to discover America. He was born in or near the great Mediterranean seaport of Genoa about 1451, his Italian name being Cristoforo Colombo. Well educated, he studied navigation and geography, becoming an expert sailor and, later, map maker. He once sailed down the west coast of Africa with a Portuguese captain, and had made voyages to other ports on the Mediterranean and England. When he was about twenty years old, he became interested in some ancient maps and writings which declared that the world was round. Columbus studied this theory and thought about it. He became convinced that it was true. For the next twenty years, he devoted himself to a plan to test his theory and show the world that goods could be shipped for less cost over a shorter distance from the Indies, by a westward route instead of across Asia.

His Struggle. Columbus had no ships of his own. He had no money to pay sailors or to meet the cost of outfitting a fleet to test his theory. So he went to the wealthy men of Genoa for aid. Refused by them, he proceeded to Venice, the great rival of Genoa, and then to the king of Portugal, where navigation was thriving. There, too, he was received coldly, and his idea regarded as fantastic. Few persons believed in the theory of a round world in those days, and many said that if you sailed west, you would fall over the edge.

AMERICA'S "CHRISTENING"
Columbus landed on the West Indies island of San Salvador. He raised the Spanish flag, claiming the land for Isabella and Ferdinand.

Finally, in 1484 Columbus came to the court of Ferdinand and Isabella of Spain. He pleaded with them for money to buy ships and to outfit them. They also were deaf to his pleas. One day, after five years of seeking aid from these rulers, he stopped at a convent named La Rabida, where he met a well-known mariner named Juan Perez. He was sympathetic to Columbus's idea and immediately secured aid from the Spanish monarchs. Columbus got his ships, small and not very seaworthy, but ships, nevertheless. His crew was taken partly from prisons, for most sailors were afraid of the dangers which they thought lurked in the unknown sea. At last, on that memorable day in August, 1492, the command to sail was given, and Columbus set out on his voyage.

The First Voyage. Not only was the trip difficult and hard in the little ships, but the anxiety of the sailors grew as the days passed with no land sighted. They grumbled, complained, and feared they would never see land again. They cursed Columbus, and pleaded with him to turn back. It is said they even threatened to throw him overboard. Day after day, Columbus reasoned with them, and promised them they would find land. After nine weeks of sailing, the ships were still tossing on an empty ocean, but as the days of the tenth week passed, the anxious voyagers sighted birds which were known never to fly far from land. Branches of trees were seen floating on the waves.

Then, on the night of October 11, nine weeks and six days after the ships left Palos, the cry, "Land ho!" was given by a sailor on watch, and the next day Columbus landed on a little island which he called San Salvador. This island is believed to be Watling's Island in the Bahamas. Sixteen days later, he saw the shores of Cuba, and in December reached Haiti, which he

DIVINE BLESSING FOR AN ADVENTURE INTO THE UNKNOWN

Columbus kneels before the priest to receive Godspeed on his fateful voyage. This was indeed a solemn moment, for there were many who believed that the venture was doomed to failure. Many months later the great voyager returned to receive regal honors for his courage.

thought was Japan. He left some of his men on the island to found a colony, and took back to Spain some of the natives. These he called Indians, since he thought he had reached the Indies.

Other Voyages. Columbus returned to Spain in January, 1493, and was received as a hero. He was appointed admiral of the ocean and viceroy and governor of whatever new lands he should discover. No longer was it difficult for him to obtain ships and men to make another voyage. Dreams of fortunes to be made in the East lured men to found new colonies. That year Columbus set out with seventeen ships and 1,500 men, but when he reached the site of his colony, he found all the men he had left had been killed. He founded another colony, returning to Spain in 1496. But, in 1498, when he made his third voyage, he found jealousy and intrigue had deprived him of the post of governor of the colony.

Nevertheless, he discovered more islands and skirted the coast of South America. Because the colonists were jealous of him, Columbus was sent back from this third voyage in chains. He was freed, but even had he not been treated so unjustly, Columbus would still have been unhappy after this voyage. He had found the "Indies," but where were the great cities and the riches that the world had heard about? Why did the natives look upon the Europeans so strangely?

After his fourth voyage, in 1502, when another colony in Central America was abandoned, Columbus returned home more heartbroken than ever. He came back to a Spain that no longer regarded him a hero. He had brought the people no riches from the "East." Queen Isabella had died, and Ferdinand was disappointed in him. He sought to return to the colonies as governor, but the world only jeered at him.

The End of the Story. Finally, on May 20, 1506, heartbroken and poverty-stricken, Columbus died in Valladolid, never knowing that the three little ships he had commanded on that August day, fourteen years before, had set out on a voyage vastly more important than finding a new route to the Indies.

The remains of Columbus lie in a monastery of Seville, where he was originally laid to rest. They were moved to Santo Domingo in 1542, and later to Havana, but were returned to Spain in 1898 when that country lost the island of Cuba in the Spanish-American war.

Then, pale and worn, he kept his deck,
And peered through darkness. Ah, that night
Of all dark nights! And then a speck —
A light! A light! A light! A light!
It grew, a star-lit flag unfurled!
It grew to be Time's burst of dawn.
He gained a world! he gave that world
Its grandest lesson: "On! sail on!"

—*Joaquin Miller.*

COLUMBUS, Ohio. One of the oldest cities in the Ohio Valley, capital of Ohio, county seat of Franklin County, Columbus is the center of industry and transportation. The site was settled in 1797 and was selected as the state capital in 1812. Columbus is the third largest city in Ohio. It has about 470,000 residents.

Located very close to the exact geographical center of Ohio, where the Scioto and Olentangy rivers meet, Columbus lies 124 miles southeast of Toledo, 116 miles northeast of Cincinnati, and 138 miles southwest of Cleveland. Reached early in 1849 by the Columbus & Xenia Railroad, Columbus has developed into a railway center into which pour the trains of a network of railroads. Chief among these are the Pennsylvania, Chesapeake & Ohio, Baltimore & Ohio, New York Central, and Norfolk & Western. Columbus has a fine municipal airport, and is served by the principal bus lines of the Middle West.

Spreading over forty square miles, Columbus has a wealth of beautiful buildings and streets. Parks cover a combined area of almost 3,000 acres. The State Capitol serves as the axis of the city. Running north and south from this structure is High Street, the main business avenue. Intersecting High Street at Capitol Square is Broad Street, a splendid thoroughfare 120 feet wide, on which front many beautiful churches, residences, and public buildings. The well-designed Civic Center contains the Federal Building, the Post Office, the Departments of State Building, the City Hall, the Leveque-Lincoln Tower, with illuminated tip, as well as a number of other notable structures.

Columbus is the home of Ohio State University, Capital University, Columbus Gallery of Fine Arts, Franklin University, Saint Charles Barromeo College, Saint Mary's of the Springs, the Ohio Archaeological and Historical Museum, and the Battelle Memorial Institute. Here, too, are many state institutions.

Columbus is a diversified manufacturing city. Here are steel mills, printing plants, textile mills, shoe factories, aircraft plants, stone, clay, and glass plants, and a host of other establishments. Much of the industrial progress can be credited to the Battelle Memorial Institute and Ohio State University's ceramics departments, which have carried on extensive research programs.

The city is governed by a mayor and council, elected through non-partisan balloting.

COLUMN, *kol'um*. Throughout the centuries, columns have been used in architecture for their decorative beauty and to support weight. Pillars can be made of any strong material — stone, wood, iron, or steel — and, in the modern age, of steel and concrete. A typical column has three parts: the *base,* upon which it rests, the *shaft,* which is the tall cylindrical mid-section, and the *capital,* which is the decorative unit surmounting the shaft.

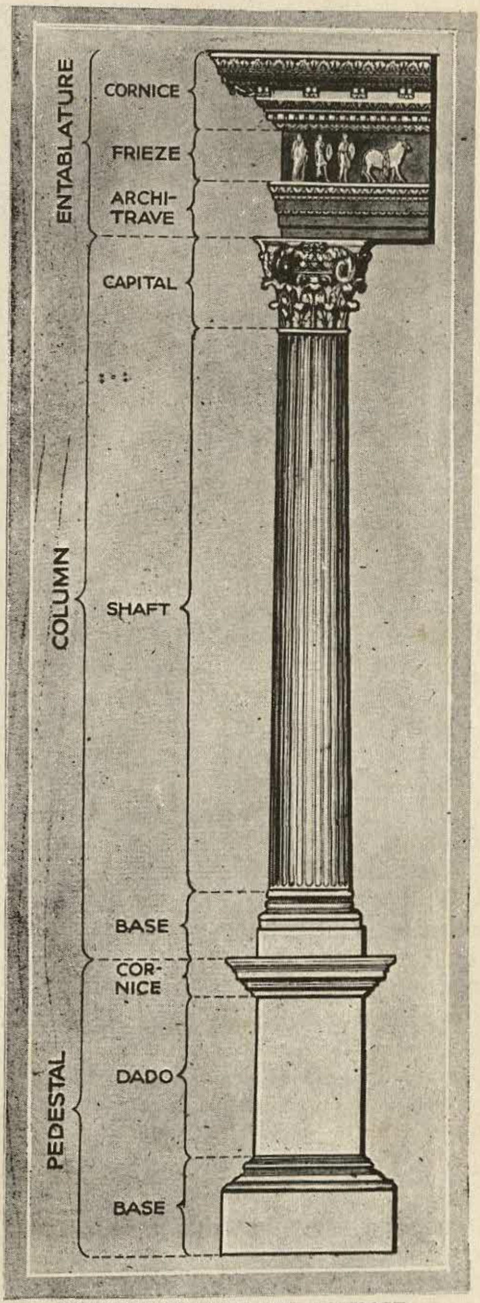
The ancient Egyptians were the first to see the dignity of a row of columns; and they used them extensively for decorative purposes, as well as for supports. A number of different designs were employed. Some columns were smooth cylinders, and others were square; some were elaborately carved, and others were in the shape of lotus leaves or sheaves of grain. Egyptian columns were massive and heavy. The Persian columns were tall and slender, with delicate and elaborate designs.

It was the Greeks, however, who developed the design of columns and employed them in every architectural purpose and interpretation. The designs of the base, shaft, and capital conformed to one of three conventionalized systems, which became the three orders of architecture—*Doric, Ionic,* and *Corinthian.*

The Doric Order. The oldest order is the Doric. This column has no base, and the shaft usually has twenty flutes, or vertical indentations. The simple capital is of two parts: the convex circular molding, or *echinus,* and the square, slablike *abacus* which it supports. The height of a column varies from five times the diameter to seven diameters in the later examples. The Parthenon at Athens is an excellent example of the Doric order.

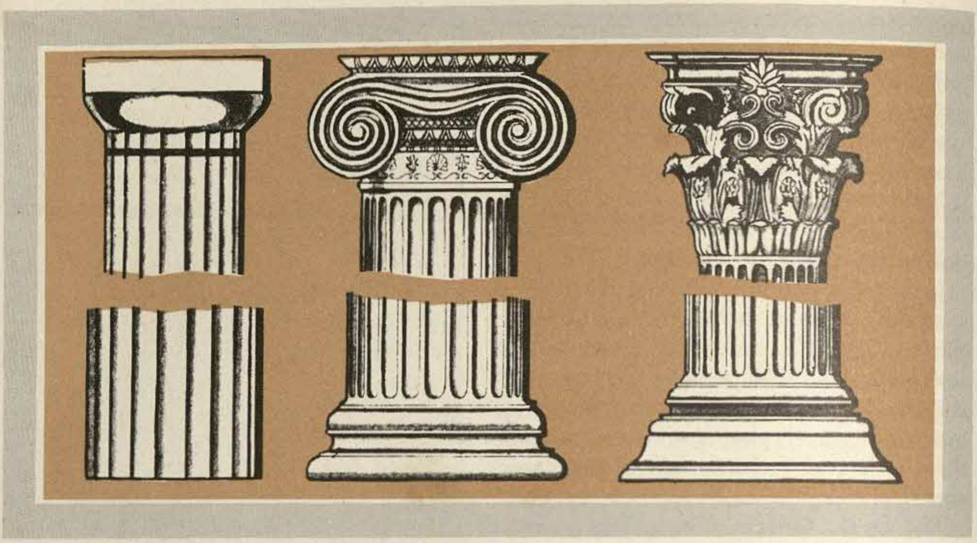
The Ionic Order. Developed by the Greeks of Asia Minor, the Ionic is more graceful and decorative than the Doric. About eight or nine diameters high, a slender shaft carved with twenty-four flutes rises from a molded, circular base to the spiral forms of the capital. These scrolls or spirals were inspired by such forms in nature as the snail shell or ram's horn. The Erechtheum at Athens is perhaps the best illustration of the Ionic style.

The Corinthian Order. The last to appear and the most ornate, the Corinthian column is a slender variation of the Ionic. It reached its highest development in the hands of the Romans. A bell-shaped cap with a group of beautifully carved ailanthus leaves distinguishes the capital. The Choragic Monument of Lysicrates at Athens and the Pennsylvania Railroad Station in New York are excellent examples of the Corinthian order, in spite of differences in



BEAUTY BASED ON SCIENCE

The proportions of classical columns were carefully worked out, and the arrangement of the various parts planned so that each unit would blend harmoniously with the whole. As buildings became more complex, much artistic detail was added to each unit of columnar structure, but the basic principles remained the same.



THE IMMORTAL TRIAD OF ARCHITECTURE

The grace and beauty of the Doric, Ionic, and Corinthian forms of column, developed by the ancient Greeks, have never been surpassed. The three orders clearly show the growth of artistic skill in Grecian civilization, from the early, simple Doric to the ornate Corinthian style.

time and purpose—the ancient and modern.

Each of these orders involved a special design for the rest of the building, particularly that of the *entablature,* the part of the structure upheld by the column. This consisted of the *architrave,* directly above the column; the *frieze,* or decorated panel next above, and the *cornice,* or topmost portion. These were all arranged to fit the rules associated with the orders.

The Roman Orders. The Romans borrowed their architecture from the Greeks, but made their own contributions. They added two new orders: the *Tuscan,* a Doric adaptation, and the *Composite,* a blending of the Ionic and the Corinthian, which was ornate and elaborate.

While the Greek column supported a flat, continuous surface, Roman columns were required to hold up arches. Soon the Roman arches became so heavy that heavy piers for support were necessary; sometimes columns were grouped between the arches, and came to be used largely for their decorative quality.

The Modern Column. In modern engineering, a column is simply a vertical support; but it has retained its original meaning in architecture—a round support as distinguished from a square one, which is a *pier.*

Surviving as the basic forms of all fine architecture are the three great orders originated by the Greeks. In these orders there is an unmatched dignity which makes a building not only impressive but definitely beautiful. Such is the Lincoln Memorial at Washington, which remains perhaps our best example of modern Doric architecture. As a unit in architecture, the chief beauty of a column lies in its "rightness"; that is, a column should be "functional." It should not be used as an ornament, but should be an essential working unit in the building. See ARCHITECTURE.

COMANCHE, *ko man'che.* When the early Spaniards were exploring the great American West, a nomadic Indian tribe called the Comanche ranged the wild region from Wyoming to Mexico. The Comanche were exceedingly warlike and probably the finest horsemen in all America. They delighted not only in hunting the buffalo, but also in raiding the early settlements of Northern Mexico and Texas. In 1875 they were forced to migrate, together with the Kiowa tribe, to a great reservation in Southwestern Oklahoma, where they have gradually become fine cattlemen. A county in Oklahoma is named for the Comanche. There are about 2,500 members of the tribe today.

COMBUSTION, *kum bus'chun.* What we call "fire" is really a chemical process. Fire and all the chemical reactions which result in the production of heat and light are called *combustion.* Most of such reactions are caused by the union of substances with oxygen, and since the air is one fifth oxygen, the common and most familiar examples of combustion are those things which burn in the air—wood and coal fires, gas flames, etc. The products of combustion may be solid, as when iron burns in oxygen to produce iron oxide or iron rust; liquid, as when hydrogen burns to produce water; gas, as when carbon burns to produce carbon dioxide. All substances that combine with oxygen in this way produce oxides.

Substances that are incombustible, or that will not burn, are already combined with all the oxygen they can hold or carry. Fireproof materials like brick, cement, and asbestos are substances that are fully oxidized. Many materials that we call "fireproof" are not truly so. Iron, for instance, is not an oxide and is incombustible in the ordinary sense of the word. Iron will not burn unless it is heated very hot and is in an atmosphere of pure oxygen.

All substances must be heated to a certain temperature, called the *kindling temperature,* before they will burn. This temperature is very different for different substances. Phosphorus, for instance, will burst into flame if exposed to the air for a short time. It combines rapidly with oxygen at ordinary temperatures, and in a short time the heat of oxidation is sufficiently high to cause the mass to burst into flame. This temperature is very different from the kindling temperature of wood, which requires the application of heat from another source before it will burn. See FIRE.

Spontaneous combustion is burning which results from a slow oxidation under conditions where the heat cannot be carried away. It accumulates to such a point that the temperature is high enough to cause flames. Rags soaked in an oil like linseed, which oxidizes slowly, sometimes burn after a time if there are several of them thrown away where there is little air circulation. Coal stored in closed places like the holds of ships sometimes burns spontaneously. Coal slowly oxidizes under any condition, but when stored away from air circulation and when fine coal is present, it may oxidize rapidly enough to ignite the whole pile.

COM'EDY. There are two main divisions of the drama—comedy and tragedy. Comedy and tragedy are alike in that both are written for the stage. Each develops its theme by the interchange of speech and action. The chief distinction between the two is that comedy ends happily, whereas tragedy ends unhappily, usually with the death of the hero. In general, the themes treated in comedy are of a lighter nature than those of tragedy. However, comedy may frequently have a serious purpose and contain sentiments quite as lofty as are found in any form of literature.

In its early beginnings, comedy consisted largely of ludicrous impersonations and gesticulations by bands of revelers parading at public gatherings, such as the vintage festivals of Dionysus, Greek god of the vine. There was little connection between the actions or speeches of the actors, who sought merely to amuse the audience by songs and extemporized jokes at the expense of the bystanders.

In the fifth century B.C., Epicharmus gave comedy a new form and introduced a regular plot. Since that time, one of the main interests in comedy is the interrelation of plots and their unusual turns and complications, ending, as stated, in the success of the leading character.

Some of the outstanding writers of comedy in their respective ages were Aristophanes among the Greeks; Plautus and Terence among the Romans; Molière, who

AN IMMORTAL OF COMEDY AT HIS BEST

Falstaff, Shakespeare's rollicking buffoon, in a scene from *The Merry Wives of Windsor.* Here he is about to be thrust into a clothes basket full of dirty linen, as a hiding place. Like many great clowns, Falstaff often "steals the show" from the main characters.

stands alone in French literature; Shakespeare, followed by Sheridan and Goldsmith in English drama; and Joseph Jefferson and Clyde Fitch among American writers.

Among the most admired comedies to be found are *As You Like It, Twelfth Night, The Merchant of Venice,* and *A Midsummer Night's Dream* by Shakespeare; *She Stoops to Conquer* by Goldsmith; *The Rivals* by Sheridan; *Rip Van Winkle* by Jefferson and Boucicault; and *The Climbers* by Fitch. See DRAMA.

COMETS. Our early ancestors were terrified when comets, brilliant heavenly bodies with long fiery tails, suddenly appeared in the sky. Although the appearance of many had been noted and recorded, it was not until 1682 that the celebrated English astronomer Halley determined that these rocket-like nebulae traveled about the sun in elongated ellipses and parabolic orbits. Years in advance, he correctly predicted a comet's return in 1758. Named in his honor, Halley's comet was last seen in 1910, and will reappear in 1985.

A comet usually consists of a head with a bright center, or nucleus, and a long, sweeping, and brilliant tail, which is always pointed away from the sun and is sometimes a hundred million miles long! The head is generally enveloped by a vast haze, which is probably gaseous atmosphere. When the comet is moving away from the sun, the tail will appear to be preceding the head. Actually, the tail is material thrown out from the nucleus and made visible by the radiation of the sun. Because of the attraction of gravity and the tenuous construction of comets, they may fly to pieces if they pass too near the sun or other great celestial body.

Comets are a part of the solar system. Their period of visibility may vary from a few days to several months, and they reappear in cycles that extend from a little over three years to once in many centuries.

The most frequently appearing comet is called *Encke's,* after the famous German astronomer who first predicted exactly its appearance in 1822. Since that date it has come again every forty months and is so bright that it is easily visible to the naked eye. *Lexell's* comet appeared suddenly in 1770, but has never been seen since. *Biela's* comet appeared quite regularly until after 1845, when it broke in two pieces and vanished. Probably the most brilliant comet of all, however, was *Donati's,* which was visible everywhere for some days in 1858 and

Courtesy Yerkes Observatory

EXQUISITE STRANGER

The spectacular flight of a comet through space. This is Moorehouse's comet, which passed by the earth in 1908. The lovely veil-like tail stretches out across the sky for millions of miles, so thinly hung together it is almost transparent toward its spreading end.

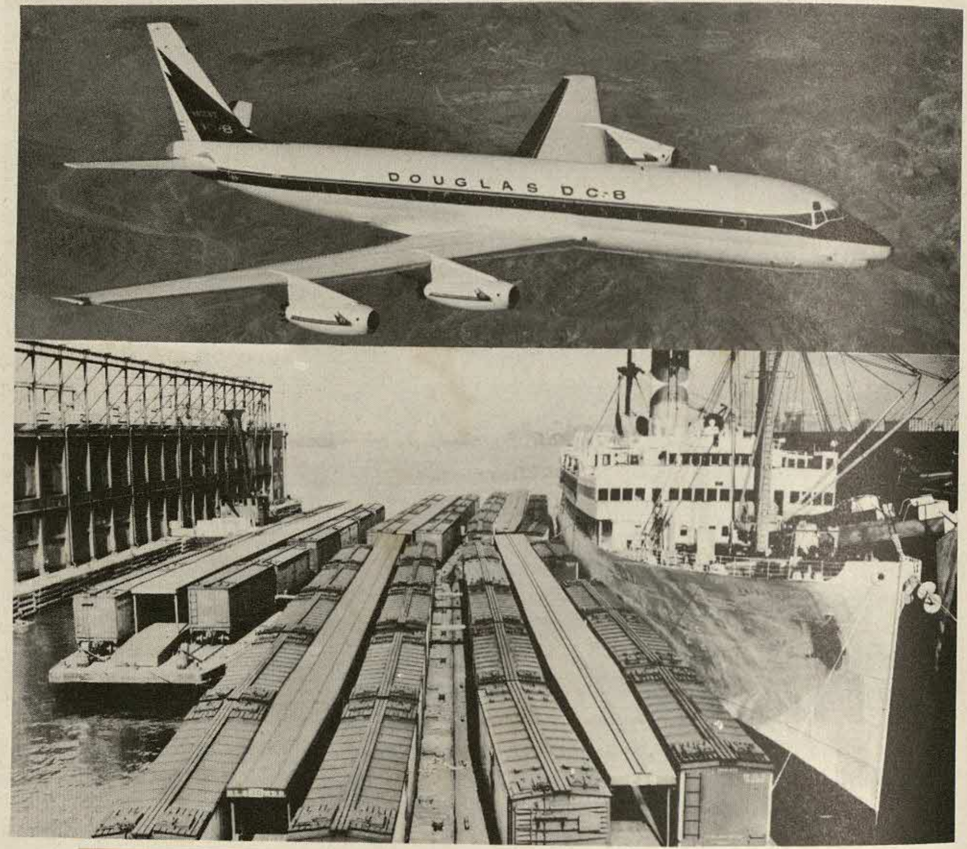
is due to return again a little over two thousand years from that date. Other comets have appeared only two or three times since the days of imperial Rome, and many can be seen only with the aid of powerful telescopes. See ASTRONOMY.

COMIC OPERA. If a play set to music is written with the idea of making the audience laugh, it is called a comic opera. Such entertainments are usually based on an amusing story, and are accompanied by bright, gay music. It is a lighter type of musical production than is the more serious grand opera.

The difference between comic opera and grand opera is not always easy to detect. Sometimes grand opera itself is very amusing, and much of its music is far from somber. But true comic operas, such as those of Gilbert and Sullivan, are satires and could not possibly be based on tragic or serious situations. In spite of the amusing quality of comic opera, this form of entertainment has given us a great deal of our most beautiful music. The *Merry Widow,* for instance, and *Babes in Toyland* are full of lovely melody. Some comic opera is now considered somewhat on the borderline between comic opera and grand opera. Beethoven's *Fidelio,* for instance, was written as a comic opera, but it is now presented as grand opera.

A modern form of comic opera is musical comedy. This type of show is based on a very simple story, which serves only as a means of presenting a wealth of gay, dancing music and a brilliant, extravagant setting.

Gilbert and Sullivan remain the greatest of modern comic-opera composers. They produced our most familiar examples of the form, including *The Pirates of Penzance, The Mikado, H. M. S. Pinafore,* and many others.



Interdependent World Markets

COMMANDER. See RANK.

COM'MERCE. Although the word *commerce* is sometimes used in connection with any business transaction or exchange of goods, we shall use it to describe an exchange between nations. Thus, the Indians and the early American settlers were engaging in trade when they exchanged beads and other trifles for furs. But the United States and Brazil are engaging in commerce when Brazil sells coffee to the United States and the United States, in turn, sells automobiles to Brazil. Commerce has been of vast importance to men for hundreds and hundreds of years. On it depends to a great extent the prosperity of nations. On it, too, often depends peace or war between nations.

The amount of commerce enjoyed by a nation depends upon the answers to six questions.

1. *Does the nation grow foods that other nations need or want?* If the nation does grow foods desired by other nations, it has

a fine opportunity for profitable commerce. Tropical countries can supply such foods as bananas, pineapples, and coffee to countries unable to grow them. Other countries grow more wheat and corn than they can use themselves, and are in a position to sell their surplus to countries unable to produce such crops.

2. *Are its people enterprising?* Suppose that a nation has rich natural resources but that the people are lazy or have a low standard of living. That nation will have little or no commerce unless energetic, enterprising foreigners promote it.

3. *Can its products be easily transported?* Suppose that a rare and delicious food is grown in the jungle interior of Africa. There will be little or no sale of that food. The jungle is so nearly impenetrable that no one can get the food to a seaport to be shipped away. The dangers of the route may be so great that the food cannot be shipped. It can easily be seen, therefore, that without transportation facilities there can be no commerce. The nations which have ships, railroads, airplanes, motor transport, and fine highways can carry their goods speedily, easily, and safely. Commerce and transportation go hand in hand; one cannot exist without the other.

4. *Do taxes and tolls cut down its commerce?* Sometimes taxes and tolls reduce the amount of commerce between nations. Suppose that matches are made in the United States but that the Japanese can make just as good matches at half the cost. The Japanese would like to sell matches to the United States. But the manufacturers in the United States have their employes and their factories to maintain; so Congress *protects* the American industry by putting such a high tax on foreign matches that the Japanese cannot possibly sell matches profitably in the United States. Commerce in matches immediately ceases.

5. *Does the nation have its own iron and coal resources?* Wherever large deposits of iron and coal are mined, factories are sure to spring up. Coal heats the boilers and furnishes the power for running machines, and iron provides the material from which the machinery is made. Now factories can turn out an enormous amount of goods—cloth and shoes and furniture and many other things. They produce more than the nation can use; so they must sell their goods to other nations which have no factories. Commerce must follow factory production.

6. *Is the nation at peace or at war?* In war times the seas are unsafe for commerce. Submarines, hidden mines, enemy warships, and airplanes interfere with shipping. Even the ships of neutral nations dare not venture forth with foodstuffs, munitions, or clothing for warring nations. The countries involved in the war cease commercial relations when diplomatic relations are severed, and each must become self-sufficient. The people of each nation must produce their own food, clothing, and munitions and must become temporarily independent of commerce. Long after a major conflict is ended, each country must rebuild its ruined trade and commerce, and such slogans as "Buy British" are published as patriotic measures to help home industries. See BLOCKADE; CONTINENTAL SYSTEM.

COMMERCE, DEPARTMENT OF. In modern civilization, commerce is so complex, and yet so vital to prosperity, that nations do all within their power to expand and regulate it. In the United States this promotion is carried on by a Department of Commerce, one of the nine branches of the Executive Department headed by the President, and under the immediate charge of a Secretary, who is also a member of the President's Cabinet. A department was created in 1903 as the Department of Commerce and Labor. In 1913 the two divisions became separate departments.

The Department of Commerce is the trade adviser of the President and of the nation. Its varied duties are handled through several bureaus: the Bureau of Foreign and Domestic Commerce, the Bureau of the Census, the Patent Office, the Coast and Geodetic Survey, the Civil Aeronautics Administration, the Inland Waterways Corporation, the National Bureau of Standards, and the Weather Bureau. Various other bureaus have been transferred. An officer in the department, called the solicitor, acts as legal adviser and checks on all department contracts.

The Secretary of Commerce is nominated by the President of the United States, by and with the consent of the Senate body. With his under secretaries and his assistant secretaries, he directs the program which fosters all commercial development, investigates foreign trade conditions through commercial agents abroad, and collects useful trade statistics which are an aid in regulating business and commerce.

COMMER'CIAL AGENCY. Modern business is conducted largely on a basis of credit, and a commercial agency is a clearing house for credit ratings. It furnishes subscribers to its service with information concerning the financial standing and dependability of business organizations and individuals.

In seeking credit, a buyer usually goes to the credit department of a corporation. If he has already established credit elsewhere, the credit manager of the corporation can consult the local agency. If the individual has no credit rating on file, the credit manager can ask the agency to investigate references supplied by the buyer and to look into his general standing.

The agency obtains credit information from varied and up-to-date sources, including banks, insurance companies, business houses, questionnaires, and personal investigation. It then compiles the information about each individual or business so investigated. An agency often publishes, periodically, for its subscribers, facts concerning businesses and individuals who have obtained credit standing.

By subscribing to the services of a commercial agency, a business house saves considerable time and money. Formerly the business had to investigate each seeker for credit with its own investigators. Now such information usually can be obtained by simply telephoning or writing a commercial agency.

COMMERCIAL LAW. In Roman times, and even earlier, merchants were allowed to trade in foreign countries under special privileges called the "Customs of Merchants." Their goods and ships were protected by these rules, which were finally gathered and codified by imperial Rome. Much later, England developed rules of merchant law which soon became part of the common law of the land.

Today, commercial law is the set of laws which controls trade and business. In the United States and Canada, it is based on the old English common law. Under commercial law, contracts, sales, partnerships, negotiable paper, etc., are regulated through the regular civil-law statutes and courts, which define and limit the business man's rights. They are essential to the smooth, efficient functioning of modern industrial life. Without such laws, it would be impossible to conduct our complex business life of today.

COMMISSION FORM OF GOVERNMENT. After the great flood in Galveston in 1900, officials of the Texas state government intervened in that city because of chaotic conditions. They suspended the mayor and all other local officials and set up a commission form of government consisting of five men. This type of government has since become a pattern for several hundred cities in the United States and Canada. A reduction of costs and an increase in efficiency are the main objects of this form of city government.

Under the commission system, usually three or five men are elected by the voters and given full power over city affairs. Each commissioner is responsible for a department of the government, such as public works and health, parks and property, or finance and accounting. In some cities the terms of the several commissioners expire in different years. The commissioners may also be recalled by the voters.

The success of the commission plan lies in the centralizing of power in a few individuals. The commission levies taxes, enacts city ordinances, makes appropriations, borrows money, and makes all appointments of minor officials according to the ability of the applicant. In some cases the chairman of the commission is called a mayor, but he is actually just one of the group of commissioners.

Today the commission plan of government is in use in a large proportion of American cities with populations of more than 50,000. Many cities, however, have turned from the old form of city government to the city-manager plan, rather than the commission system. Since World War I there has not been a strong trend to the commission system. See CITY MANAGER.

COMMITTEE FOR INDUSTRIAL ORGANIZATION. See LABOR ORGANIZATIONS.

COMMITTEES OF CORRESPONDENCE. There was no feeling of unity among the American colonists before the Revolutionary War. In fact, there were many jealousies among the colonies, and, because of poor means of communication, surprisingly little contact. To create a realization of common interest, radical patriots formed committees of correspondence, which were actually illegal propaganda groups maintained to foster dissatisfaction with British rule.

Many colonists hated British taxes and British rule, but had given little thought to active efforts toward independence until Samuel Adams organized the first committee of correspondence in Massachusetts Colony in 1772. The members of this committee compiled and circulated the many grievances of the colonists and helped combine the forces working for American independence. Their efforts led directly to the First Continental Congress in 1774 and the Declaration of Independence. See ADAMS, SAMUEL.

COMMODORE. See RANK.

COMMON CARRIER. This term refers to a private individual or a company engaged regularly in conveying passengers or merchandise for all persons in need of such service. The term embraces carriers both by land and by water. These include railroad companies, motorbus lines, street railways, teamsters, porters, etc., and the owners and masters of every kind of vessel who announce themselves to the public as carriers. The route of a common carrier may extend across a continent or overseas, or it may be from one town to another. In some jurisdictions, telegraph companies have been included in the foregoing list. In the sense that a hotel may not refuse service to responsible applicants if they are able to pay, a hotel is essentially a common carrier.

Carriers of freight must serve alike all who offer business, provided the merchandise to be forwarded is of a legitimate and lawful character and not dangerous to life or property, and if the shipper is able to pay for the service, fee for which may lawfully be demanded in advance. Carriers are responsible for loss during transportation from any cause except an act of God, a public enemy, or insurrection; but the carrier is relieved of responsibility for losses which occur from natural causes, such as frost, decay of perishable articles, fermentation, evaporation, and the like.

In several states of the Union, a railroad company is excused by law from being a common carrier of livestock and may refuse it for transportation; however, if it accepts livestock for shipment, it becomes liable as a carrier. In Canada, railroads need not handle explosives or other goods of a dangerous nature, or freight insecurely packed or likely to damage cars or other freight.

COMMON LAW. Centuries ago in England there was no written law, all citizens relying upon customs and common usage as the highest legal authority for protection of their rights. Over a period of time there thus developed a mass of precedents and principles which came to be called common law, in contrast to statute, or written, law.

Although common law is unwritten, it is nevertheless binding unless contrary to a written statute. The United States inherited its common-law principles from British colonial days, and many of them were written into the Federal Constitution. The United States has since accumulated rules and decisions of its own, which now form a rather uniform set of common unwritten law. See CIVIL LAW: LAW.

COMMONS, HOUSE OF. See GREAT BRITAIN, subhead *Government.*

COMMONWEALTH OF ENGLAND. In English history the period from 1649 to 1660 is known as the Commonwealth. After Charles I was dethroned and beheaded in 1649, England had no king but was ruled by Parliament under the leadership of Oliver Cromwell. The Commonwealth came to an end with the restoration of the monarchy in the person of Charles II, in 1660.

COMMUNE, *kom mune'*. In France the mayor is not a city official but the head of a *commune,* the smallest French governing unit. A number of communes together form a *departement,* the French equivalent of a state, headed by a *prefect.* A commune may consist of several villages or merely a part of one large city. Belgium and several other European nations also have communes.

In medieval times, a commune was any village to which a charter of liberties had been given by a feudal lord in exchange for the services of the population, especially in time of war. The word itself means any group of people governing themselves as a unit.

COMMUNE OF PARIS. Twice in French history the city of Paris has been seized by radical mobs which set up a form of government called the *Commune.* The first Commune appeared in 1792, during the French Revolution. Members of the Commune government were delegates chosen from the administrative districts of Paris and included that famous revolutionary figure, Robespierre. They assumed all power of government and attempted to set up a dictatorship, only to be thwarted by opposition from numerous political factions, including the Girondins. The period of the commune lasted until 1794.

A second Paris Commune sprang up in 1871 after the defeat of the French in the Franco-German War. It was a revolutionary attempt at self-government on the part of the city of Paris, because of discontent and suffering during the war. The uprising began on March 18 after the German army left Paris. It was finally suppressed by the regular French army from the provinces, backed by the National Assembly. It required ten weeks' time, the slaughter of thousands of people, and the burning of the magnificent Palace of the Tuileries, before Paris was subdued. See FRANCO-GERMAN WAR; FRANCE; PARIS; FRENCH REVOLUTION.

COMMUNISM, *kom'yu niz'm.* Today the word "communism" generally refers to the political beliefs of the Communist party and the Communist system as it exists in Soviet Russia and in other nations under Communist control. The small group of men who control the Communist party in Soviet Russia are the real heads of the Communist party throughout the world. They direct the activities of Communist agents, who work tirelessly to stir up social discontent in non-Communist countries in order to bring about the downfall of the governments of these lands. Once the non-Communist governments have been thoroughly weakened, the Communist agents set up Communist states by revolution.

Under a Communist regime patterned on Soviet Russia, the government takes over all property, including all farm lands and all industry. In theory, the working people are the real owners of the means of production, but in practice a small group of Communist "bosses" has full control. This group selects Communist party members as candidates for all government posts, and since these Communist candidates are the only candidates, the voters have no choice in selecting their "respresentatives." The average citizen must work for the state, which teaches him Communist doctrine and denies him the right to learn about other countries and other political beliefs. He must obey without question the laws laid down by his Communist masters, for if he shows any sign of independence, he may be arrested without warning and either executed or thrust into a slave-labor camp as an enemy of the state.

Modern Communist doctrine, calling for world revolution against governments based on belief in free enterprise and democratic freedoms of thought and action, grew out of interpretations of the theories of the German radical, Karl Marx. It is very different from the "communistic" ideas of earlier reformers. These reformers, who established experimental communities in many lands, believed that all should work together for the good of all, with all sharing the fruits of this common labor. See RUSSIA; SOCIALISM.

COMMUNITY INTERESTS. Your family, your relatives, your friends, and you, yourself, are all a part of a community. Any group of people, living together and working for the common welfare, make up a community. It is not a collection of buildings—here a group of stores, there the churches, and there the schools. Rather, it is like a large tree, whose roots, trunk, bark, limbs, and leaves work together for a common purpose. And the boundaries of the community are not limited by law but by the purposes, the industries, and the general spirit of co-operation that bind one great group of people into a unit.

The Nation, the State, and the Community. The Constitution of the United States, and the national Congress in its acts, deal with principles applicable to all the states. Each state in like manner deals only with those that have to do with general conditions within itself. By far the greater number of interests are left to the people themselves in their own local self-government. It is just here that the community must come to function more fully. The home, the school, and the church, with all their varied activities, are primarily organized, maintained, controlled, and developed as local community institutions. The state and the nation, through legislation and otherwise, may stimulate and assist these, but the main direction must come not from without, but from within.

These multiplied community interests impose community obligations which must be met by the people themselves. The general policy of the nation is to do as little as possible itself, leaving to the states, whatever can be done by them; and the state, following the same policy, leaves the rest to the community. It is not strange, therefore, that inactive communities lose out and alert communities forge ahead.

What Is a Community Interest? Much of the business of the community is private. Other interests, while privately owned and operated, are more directly and vitally related to the public; such, for example, are most public utilities—light, gas, water, telephone, street cars, etc. Public ownership of these is often advocated and in some instances practiced; public ownership of water and light is common. But whether the public owns and operates these or they are left to private enterprise, they are so vitally related to all the people that they are essentially community interests. The fact that their operation yields a large revenue often creates still further problems as to control and direction.

Schools and churches are outstanding examples of real community interests, but even the schools are regulated, in part, by state laws. Community health, involving quarantine laws, hospitals, and local health officers, is certainly a primary interest of any community. So, too, is the beautification of the community, the planting of flowers, trees, and shrubs along the public streets, and the great parks and playgrounds that are found in many communities. Charities, poor relief, home-talent plays, community music, and singing are certainly not to be overlooked. Nor is the recreation of the community, provided by schools, public parks, golf courses, tennis courts, the Y. M. C. A., and the Y. W. C. A. Scarcely one of these community interests operates independently; all are centered around what has come to be known as the community center.

What Is the Community Center? In many communities there is a common meeting place for recreation, fellowship, or educational advancement. And in nearly every case, this meeting place is one of the large schools of the community. In many communities, scarcely an evening passes without some activity in this neighborhood center. It may be a play, a dramatic or educational club meeting, or even an athletic contest. Or it may be a gathering of the older people of the community for a discussion of some phase of civic welfare. Again, it may be a reunion or celebration for people of all ages.

Father of the Community Center. It was Professor Edward J. Ward, a specialist in community organization, who was largely responsible for bringing about the use of the school as a community center. This was his plan: Interested adults should meet and organize into a sponsoring club. This organization should then appear before the proper authorities and ask for the use of the school building for conducting a neighborhood forum in much the same manner as a literary society would be conducted. This plan would establish a basis for ever-widening activities in the community forum, eventually broadened to include athletic contests, dramatic and social clubs, and general meetings of public interest.

To aid the progress of community forums along these lines, many state legislatures passed laws providing that a majority of citizens in a district might appeal to the board of education to change the community forum into a community center. The board would then so designate the building and, further, would furnish heat, light, and janitor service, so that the building might be used conveniently.

The Public Community House. Many smaller communities have gone a step farther. The citizens have patriotically erected a special community house which is used for all the popular activities of the community. Some of these buildings have cost many thousands of dollars, financed by the sale of stock after the election of officers of the corporation, in the same manner as an industrial organization would operate. Upkeep of the community center is met by charging small fees, such as admissions to games or entertainments, and, at the end of the year, by a "money-raising" campaign to cover any deficit. As yet, however, this sort of community house has not come into general use, partly because of the amount of capital necessary. Some poorer communities have met the problem by buying and remodeling an old residence or recreation hall.

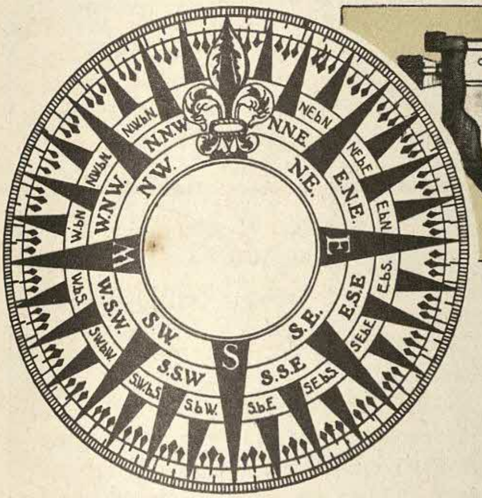
COMPANY. See PARTNERSHIP; CORPORATION.

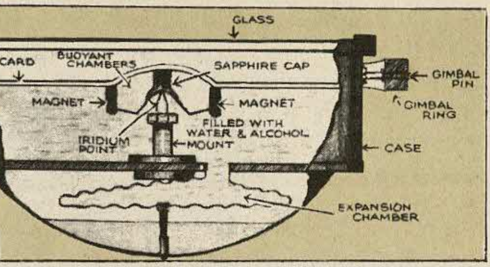
COMPASS, *kum'pas.* For centuries, daring explorers of faraway lands and brave rovers of the seas have been greatly aided by the use of the compass. Briefly, the purpose of this instrument is to indicate north and south so that anyone can determine exactly in what direction he is traveling.

The earth is, in reality, a great magnet, the strongest points of magnetism being located somewhere near the North and South poles at points known as the magnetic poles. These magnetic poles have sufficient pulling force to keep a magnetized needle always pointing in their direction (see MAGNETISM). It is apparent that the needle of any compass must be *floating,* so that it will rotate easily.

Mariner's Compass. This is probably the most important type of compass, for without it the sailor is helpless in trying to find his way accurately. The mariner's compass consists of a circular card to which is attached a small, pointed magnet. The card is divided into 32 equal parts, or 360 degrees, and, like other compasses, the mariner's compass swings freely in a horizontal position. Each of these 32 parts is a definite compass direction and has a specific name. For example, between north and northeast on the mariner's compass there are three other directions, each with a definite name. These directions are called points, half-points, quarter-points, and eighth-points.

As the compass card swings around with the needle pointing to the north, it becomes a simple matter for the experienced sailor to determine in what direction his ship is





THE SAILOR'S BEST FRIEND

Guide for the daring adventurers of old and for the navigators of today, the magnetic compass has rendered long and distinguished service. The "compass card" (left) with all points marked, floats in liquid in a metal case (above).

sailing. But in determining his bearing, he must also allow for two elements of error commonly known as *variation* and *deviation*. Variation is the error shown by the compass between actual north and magnetic north. Deviation is the amount of error in the compass due to faulty adjustment.

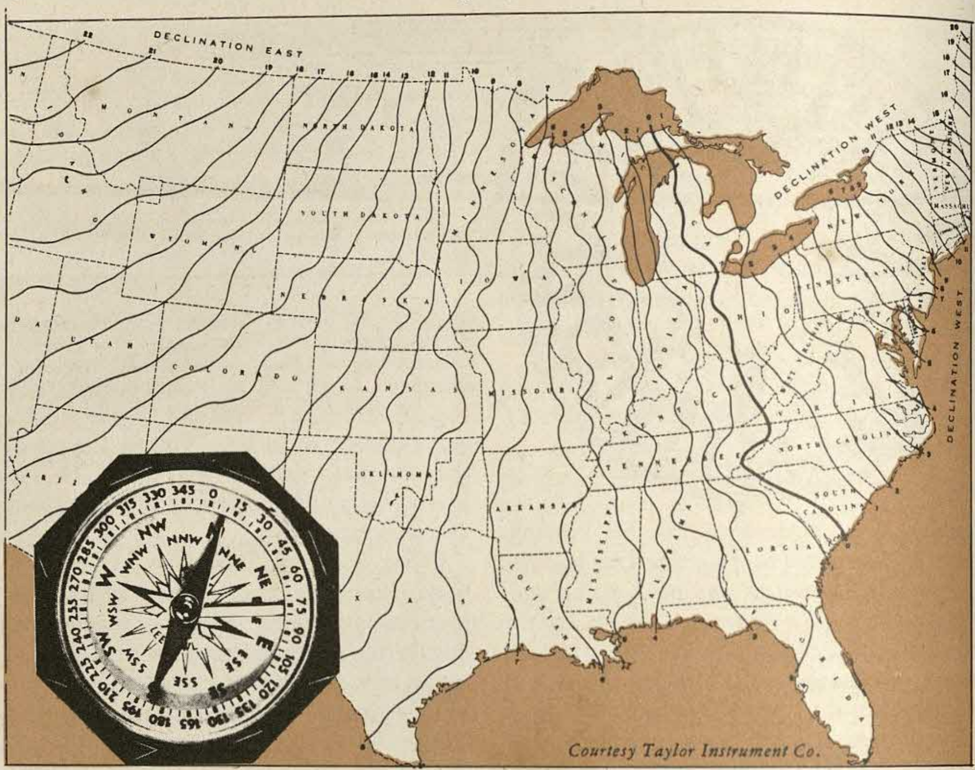
Every compass will be in error because of the fact that the magnetic pole is not a true north. To aid navigators, the various governments of the world publish charts and tables to enable navigators to determine the amount of variation at any point. Magnetic disturbances from the steel hull of the ship will also throw a compass into error in many cases. Both variation and deviation have been largely eliminated by the use of the gyrocompass. See GYRO-COMPASS.

The mariner's compass is usually "floated" in liquid within a metal case, and is suspended in a box which allows the compass to level itself regardless of how the ship may be rolling or pitching. The liquid surrounding the mechanism also helps to keep the compass card always on a horizontal plane.

The compass was of inestimable value to early explorers because in those days most of the seas were unknown and uncharted and there was no radio communication to give a ship its bearings. But valuable as it was to the early adventurers, it is of just as much worth to hunters, fliers, seamen, and explorers of today. Without the aid of the compass, many lands would be unknown today and all maps would be crude and very unreliable.

Other Kinds of Compasses. One of the most commonly known compasses is that used by surveyors. It has a magnetized, needle moving over a compass card marked in degrees, minutes, and seconds instead of in directions. It is mounted in a circular case with two sights to give the actual angle in degrees, minutes, and seconds that any given line of sight will vary from true north. A level and a tripod keep the compass always in a horizontal position so that the needle may revolve easily.

Still another compass that has come into common use in recent years is the aircraft compass. With the rapid development of the airplane, a compass had to be designed that would give the pilot exact directions at all times. In building this compass, two great problems had to be solved. One was to find a means of overcoming the effect of engine vibration on the compass, and the other was so to design a compass that it would not "lag" behind when the plane made sudden changes of course or speed. To overcome the first difficulty, compasses were mounted in horsehair and cotton waste and later in a special kind of rubber. The second difficulty was overcome by the adoption of a grid ring to replace the usual compass card. Like the mariner's compass, airplane compasses are usually floated in alcohol, a liquid which is not affected by ex-



Courtesy Taylor Instrument Co.

CORRECTING COMPASS READINGS FOR MAGNETIC DECLINATION

Maps are drawn with the North Pole as true north, but magnetic north is far enough from geographic north to cause variations of the compass. Navigators correct this by applying the "angle of declination." Only on the heavy black line does the compass needle point exactly north. Inset, a precision pocket compass.

tremes of temperature such as the airplane meets.

History of the Compass. Although the Chinese were once given credit for originating the compass about 2000 B. C., there is nothing to prove this origin. The first definite record of a Chinese compass was in the year A. D. 1297. But since the compass was also used in Europe at that time, it still remains a mystery as to who invented the instrument. It is certain that the compass was first generally used about the latter half of the thirteenth century, about two hundred years before the voyages of Columbus.

The earliest compass was merely a stone called a *lodestone*. Tied on a string, it had a tendency to swing to a north and south position if left undisturbed. Later a magnetized needle pushed through a cork and floated in a vessel of water gave rise to the designing of compasses along the lines they follow today. Columbus is generally given credit for the discovery that the compass needle does not point due north.

Boxing the Compass. No doubt you have heard the expression *boxing the compass*. It merely refers to the ability of a sailor to name all points of the compass in rapid succession, regardless of which direction he takes as his starting point. A pilot or helmsman must be so skilled in this work that it becomes almost second nature to him.

COMPASS PLANTS. Some plants have leaves which are normally turned toward certain points of the compass and which may thus be of value in locating directions. East of the Mississippi River, the common compass plant is the *prickly lettuce,* the leaves of which normally point north and south when the plants grow in the open, a

FLYING ON INSTRUMENTS

Inertial guidance system is a special type of gyrocompass that gets a fix and then takes over. Left, the system being checked out will automatically guide supersonic airplanes with the sensitivity and precision of the longest-range ballistic missiles.

Sperry Gyroscope Co.

SCAR ON A STAR

An ordinary compass is not of much value on nuclear submarines that travel under the ice and remain submerged for months. Right, SCAR (submarine celestial altitude recorder) obtains and relays celestial navigation information while the sub is submerged.

characteristic that is particularly marked in young plants. As a matter of fact, the common lettuce of gardens will become a compass plant if allowed to produce a seed stalk, since the leaves on the upright stalk exhibit polarity in a similar manner to its wild relative.

It should be noted that a half twist of each leafstalk places the leaves in such a position that one edge is turned toward the midday sun. The reason for all this seems to be that by turning their edges upright, the leaves escape the hot noonday sun, and by pointing north and south they secure the full benefit of the soft morning and evening light, since the sun rises in the east and sets in the west.

The *western compass plant* is a familiar sight on the broad prairies of the Middle West, where its huge, deeply cut leaves and tall, stately, yellow-flowered stalks are very conspicuous. The leaves point north and south with such dependable regularity that many a "prairie schooner" of old was steered over its pioneering path across the "roadless, boundless plains" by this faithful guide, whose virtues have been extolled by Longfellow in one of his poems.

In addition to its home on the plains, the western compass plant may be found in fields, meadows, and pastures from Ohio to South Dakota and southward to Alabama and Texas.

Other plants that are useful in locating directions are the *lichens,* which commonly grow in greatest abundance on the northern exposures of tree trunks, and common *green moss,* which ordinarily grows most luxuriantly on the north side of exposed rocks. There are also a number of wild flowers that turn naturally toward the south in order to secure maximum sunlight. The species of such plants can readily be learned by observation.

COMPOSITE, *kom poz' it,* **FAMILY, or COMPOSITAE,** *kom poz' i te.* In all the plant world, this is the largest family. The species number well over 12,000 and are grouped into nearly 1,000 genera. The outstanding feature of the family is the crowding of many small flowers into one head, often giving the impression of one large flower. To make the deception still more complete, the outer petals of the flower are usually different from those in its center.

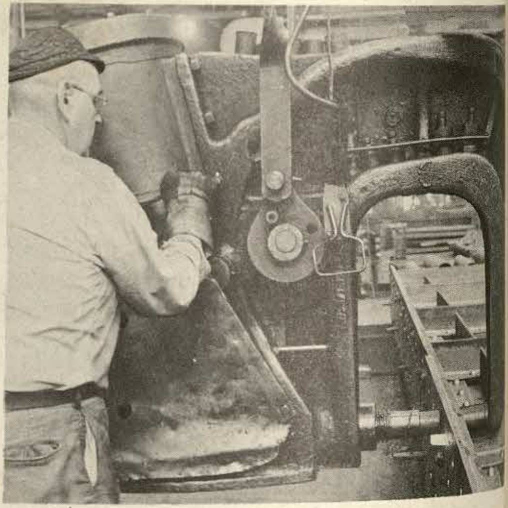
Most of these plants are found in temperate climates, although they often appear in warmer lands as well. For the most part, they are herbaceous and grow close to the ground with leaves arranged as a rosette, as in the case of the daisy and the dandelion. In warmer lands they often appear as shrubs or small trees.

Usually, flowers of this family have five united petals in the corolla. The outer flowers are irregular in shape and are often sterile and imperfect as well. They have five stamens and free filaments. Because of the crowded heads, these flowers are easily pollinated by bees.

Nearly a tenth of all plant life belongs to this one family. A few well-known flowers of this family are the aster, chrysanthemum, dahlia, daisy, goldenrod, and thistle. The lettuce plant also belongs to this classification. Although a few of these plants are used for food and medicine, most of them are merely ornamental and are often grown in flower gardens. (For further information, refer to the plants listed above.)

COMPOSITION OF FORCES. Complex as it may sound to the beginner, the theory of composition of forces is really a simple one. In physics, when two or more forces are pulling on an object, each force in a different direction, the combined, or resulting, force is known as a *composition of forces.*

Suppose you had a block of stone weighing 100 pounds. Attach force *A* which pulls, let us say, 80 pounds in a north direction. At the same time attach force *B,* which pulls 80 pounds in a west direction. The stone would move neither north nor west, but in a northwest direction. The equivalent force of these two, if applied directly in a northwest direction, would be known as the *resultant.* It is usually somewhat less than the total of forces applied in different directions. In this case, then, the total force applied would be 160 pounds, but the resultant would be less, due to the fact that part of the power is lost because the forces partially pull against each other.



U.S. Steel

AIR CAN HAMMER RIVETS

This portable pneumatic riveting machine drives a rivet through a girder. A white hot rivet awaits its turn.

COMPRESSED AIR. Imagine, if you can, an iron tank with a hundred golf balls inside banging against one another. Now, if another hundred are added, the balls will bang against the walls faster and harder than before. As more and more balls are added, the pressure on the walls will become so great that the tank will burst open. That is a picture of how compressed air would look if you could see it. The balls represent particles of air called molecules. As air is pumped into a tank, the pressure against the walls becomes greater and greater. Moreover, air forced into a tank in this way will become heated and, upon being released, will take up heat or seem cold to the touch.

Let some air out of an automobile tire. Notice how cold it seems to your fingers. In general, then, the closer molecules are to one another, the greater will be the heat produced; and, as they separate again, they will produce cold.

The Air We Breathe. If you were standing at sea level, the air would be pressing upon you at about 14.7 pounds per square inch. In spite of this pressure, you would feel no discomfort because the pressure inside your body would be just as great. But if the air were suddenly taken from around your body, you would explode like a giant firecracker because there would be a pressure of 14 pounds per square inch pressing against the interior walls of your body. Naturally, your body could not stand such a pressure. But in storing compressed air in tanks for usage, this pressure may often mount as high as several hundred pounds per square inch. A tank must be of perfect steel construction to hold such a powerful force under control.

The Force with a Thousand Uses. The greater the amount of air compressed or forced into a tank, the more power it gives off when liberated. Man, taking advantage of this fact, has forced air to perform countless tasks for him. Some of the most common of these tasks are to keep automobile tires "pumped up," to operate an air rifle, or to furnish power for operating the brakes on a train. Many drills, hammers, and other tools are operated by compressed air. It is often used to force water through pipes, to operate elevators, to open and close canal locks, and to drive a fine stream of sand for cleaning brick—or stone—faced buildings or to remove hard materials like carbon. It is used in keeping deep-sea divers supplied with air while on the bottom of the sea. Only recently it has been used in the "iron lung," a machine for the treatment of infantile paralysis, a disease in which the muscles of the chest become paralyzed and breathing is impossible without some aid.

COMPROMISE, *kom' pro mize,* **OF 1850.** War between the two great sections of the United States—the North and the South—might have occurred a decade before it did, had it not been for the Compromise of 1850. This agreement between the leaders of the *slave* and *free* interests in Congress staved off the conflict for ten years.

The compromise was brought about by the crisis which arose when California sought admission to the Union as a free state in 1849. The great territory had been ceded to the United States by Mexico a year earlier, and, as was the case with all new territories, a dispute had arisen as to whether it should be a slave or a free state. Arguments in Congress were bitter. Finally, Henry Clay, the brilliant Senator from Kentucky, proposed a compromise which received the backing of Daniel Webster, representing the North, and John C. Calhoun, of the South.

The bill provided that California be admitted as a free state; that Utah and New Mexico be allowed to decide for themselves whether they wished to be slave or free; that the slave traffic in the District of Columbia be prohibited; and that the laws forcing the Northerners to return runaway slaves be more strictly enforced. It also authorized the payment of $10,000,000 to Texas for debts contracted when it was a republic.

The compromise, similar to the others that preceded the war between the states, was only a truce; it did not effectively settle the quarrel that was to lead to bitter conflict. Strangely, the debate in Congress on the compromise was the last engaged in by Clay, Calhoun, and Webster. Calhoun died that year, Clay died two years later, and Webster became Secretary of State under President Millard Fillmore.

COMPTROLLER, *kun tro'lur.* A person in charge of the receipt and payment of moneys is a comptroller. He is usually connected with a department of government, and is, therefore, a public official. In the United States government there are two comptrollers, called the Comptroller-General and the Comptroller of the Currency. The latter official administers the laws relating to national banks. The former official examines all government expenditures; if he believes there is a question as to the legality of any expenditure, his powers enable him to refuse payment.

In some states and cities, officials with similar duties are called comptrollers, although usually the duty of disbursing money, as well as of receiving it, is vested in officials called *treasurers.* See TREASURY DEPARTMENT.

CONCERTINA, *kon sur te'nah.* An improvement on the accordian, the concertina was invented by Charles Wheatstone in 1829. Unlike the accordion, in which one reed produces a note when the bellows is expanded and another when it is compressed, most concertinas have reeds which act whether the bellows are expanded or compressed. The extended range (about four octaves) and soft but penetrating tone, capable of the most delicate gradations from *pianissimo* (very soft) to *forte* (loud), make the concertina, well played, a really artistic instrument.

CONCH, *konk.* Many large mollusks grow in big spiral shells and are called conchs. They are found off the coast of Florida and in the West Indies, although some varieties are also found in the East Indies and along the Atlantic coast of the Northern United States.

Conch shells have a number of uses. They are used in making porcelain and buttons and are also burned into lime. An inexpensive kind of cameo is carved from them. In the East Indies, one species is made into a musical instrument by punching holes in the tip and fitting the shell with a mouthpiece.

CONCLAVE. The word *conclave* means a private or secret meeting of a group of people. In French and Latin, the term means "a room which may be locked."

Originally, the word related only to the assembly of Roman Catholic cardinals for the election of a Pope. Ten days after the death of a Pope, the cardinals meet in a part of the Vatican which has been divided into several small rooms, two or three of which are allotted to each cardinal. After the first day they are locked in and are allowed no communication with the outside world until after the election. Even the food, passed through a window, is examined so that no letters or notes may reach the cardinals. See POPE; SACRED COLLEGE.

CON'CORD, BATTLE OF. The first and one of the most famous battles of the Revolutionary War was the Battle of Concord. It was fought in and around Concord, Mass., on April 19, 1775. See LEXINGTON, BATTLE OF.

CONCORD, MASS. Ralph Waldo Emerson had in mind the attractive town of Concord when he penned this inspiring verse for the monument at Concord Bridge:

> Here once the embattl'd farmers stood,
> And fired the shot heard round the world.

It was at Concord that a group of New England farmers drove back a detachment of British soldiers on April 19, 1775, marking the start of the American Revolution.

Located twenty miles northwest of Boston, Concord is still a small town. It has a population of about 12,000. But it is of national importance in American literature as well as American history. Concord was the home of such famous literary figures as Ralph Waldo Emerson, Henry Thoreau, Louisa M. Alcott, and Nathaniel Hawthorne.

CONCORD, N. H. Seventy-five miles northwest of Boston, on the Merrimack River, lies Concord, capital of New Hampshire. It is the third largest city in the state. Saint Paul's School, an outstanding preparatory school for boys, is located there.

FIRING THE SHOT HEARD 'ROUND THE WORLD

The famous old bridge at Concord, Mass., was the scene of the first clash in the American War for Independence. Here, in the spring of 1775, British troops of General Gage, seeking rebel munitions, met and retreated from courageous minutemen.

The former residence of Mary Baker Eddy, founder of Christian Science, is in Concord; it is now known as Pleasant View Home, and is a home for aged followers of her faith. An industrial and manufacturing center, Concord is famed especially for its near-by granite quarries.

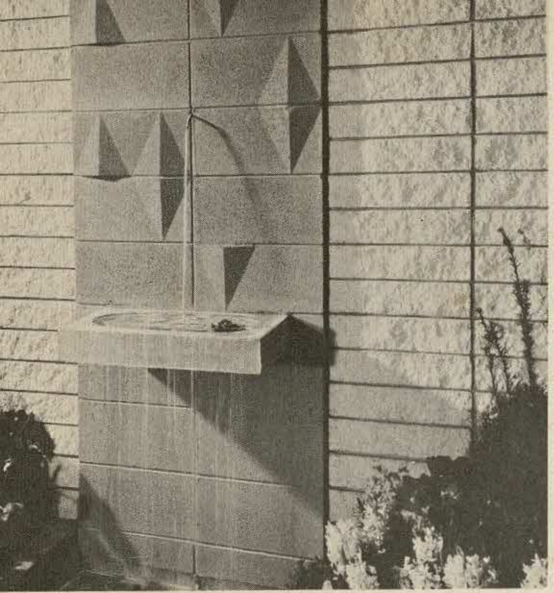
A trading post from 1660, the present city of Concord became the village of Penacook in 1725. Eight years later the name was changed to Rumford. Renamed Concord in 1765, the village was made capital of the state in 1808. In 1853, it was incorporated as a city. The population is about 29,000.

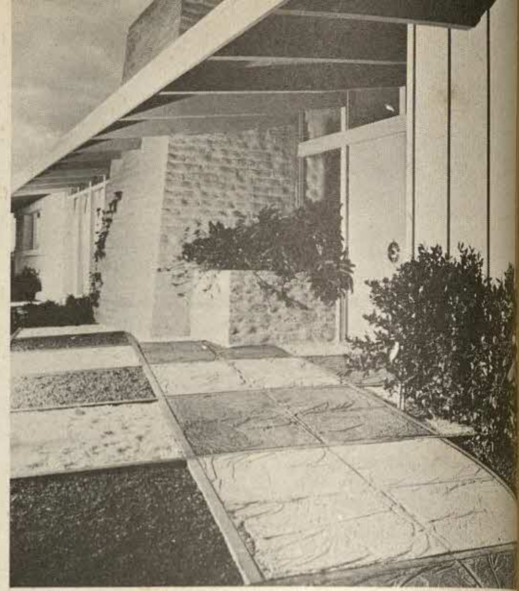
CONCRETE. In this hard, strong, lasting substance we have a man-made building stone that surpasses anything to be found among natural construction materials. Concrete is a mixture, in proper proportions, of portland cement, sand, crushed stones or pebbles, and water. The cement and water form a paste; the other materials are known as aggregates. By means of many tests and experiments, engineers have worked out exact tables of specifications designed to meet the requirements of any particular job. In all cases, however, the ratio of water to cement remains the same in any one table, though the other ingredients may be varied for special purposes.

On large jobs, the materials are usually stirred together in a drumlike mixer that is slowly turned by gas, steam, or electric power. The mixture at first looks like soft, wet mud. While in this condition it is dumped into molds or forms, where, shortly, it begins to stiffen and harden. The water and cement, in this process, act as a binder, welding the aggregates into a firm mass. The hardening process goes on for days or weeks, until the concrete is, in truth, man-made stone. During this hardening, the mixture is kept from drying out until it has acquired the necessary strength to resist the action of sun, wind, and other natural elements.

Interesting Facts About Concrete. Engineers have found that the more slowly the concrete is allowed to dry out, the stronger it finally becomes. When mixed for three minutes, it gets much harder than when mixed only one minute. The mixture hardens more rapidly in warm weather than in cold. Leaf mold and other impurities weaken concrete; hence the mixing water must be pure enough to drink.

Concrete stretches or expands as the thermometer rises; that is why joints are put in pavements. At night, when cold air chills and shrinks the top surface of a concrete road, the edges rise a tiny distance off the ground. Finally, when placed in large





CONCRETE'S TEXTURES ARE AS VARIED AS ITS USES

Left, rough-finished,' decorative concrete blocks create an attractive fountain insert in a stone wall. Right, wood-divided concrete walk and graveled terrace lead to sheltered entrance of a modern house. Fireplace wall and planter are of slump block, a new type of concrete masonry.

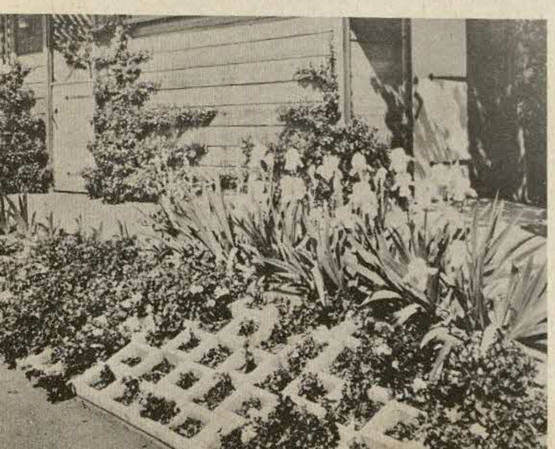
masses, concrete gets warm during the first few hours while hardening. In tunnels, freshly placed concrete often makes it unbearably hot for workers, and when big dams are built, refrigeration pipes are hidden in the fresh concrete to keep it cool.

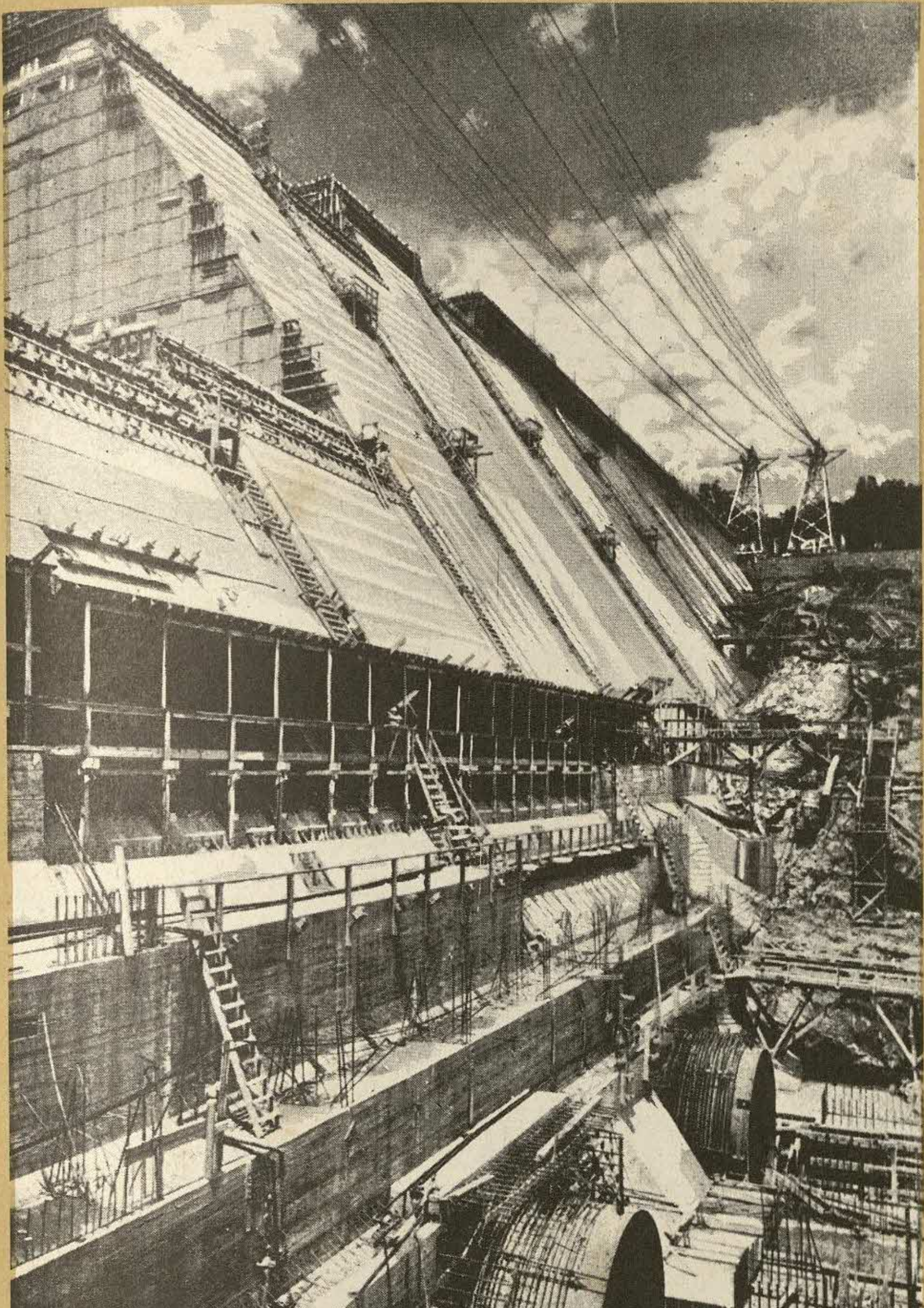
Our Concrete Age. No one knows who discovered the process of making concrete, but it is an interesting fact that the massive foundations of the Castle of Sant' Angelo, in Rome, built in the year 138, are made of a kind of concrete. So, too, is the dome of the Roman Pantheon. The discovery of portland cement, in the eighteenth century,

VERSATILE CONCRETE FINDS ITS WAY INTO THE GARDEN

Below left, concrete single-core units on sloping surface prevent soil from being washed away. Cores may be filled with soil and planted with flowers, shrubs, or ivy. Below right, curved concrete lattice wall serves as a screen to insure privacy and allows sunlight and breezes to pass through.

All photos, Portland Cement Association





Courtesy Portland Cement Association

THE CONCRETE CLIFFS OF NORRIS DAM

This colossus of power rises in the Clinch River near Knoxville, Tenn., where the rushing waters are harnessed to turn out many thousands of horse power. The project required vast amounts of concrete, for the entire dam is built of it. The great pipes at the bottom carry the water to the turbines in the power house, which are built over this spot. Such dams electrify the countryside, control floods, and conserve natural resources.

PRESTRESSED CONCRETE GIVES BUILDERS A NEW, STRONGER MATERIAL

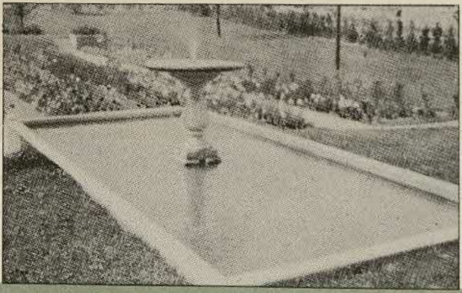
All photos, Portland Cement Association

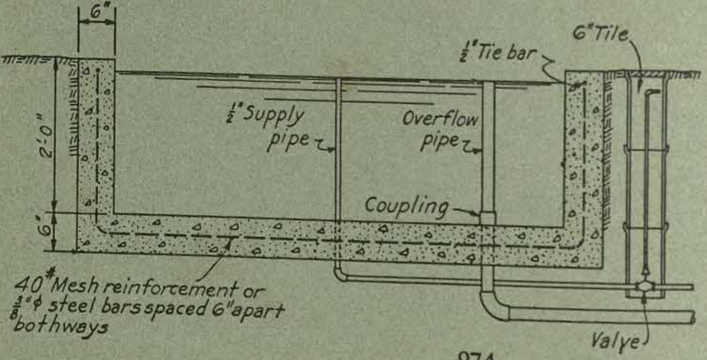
The housewife at left shows how a row of books can be supported by applying pressure at ends. It's much the same with the bridge above. Here, the girders used have been precompressd or prestressed by stretching the steel reinforcement. Prestressed concrete makes possible the building of long bridge spans.

marked the beginning of the modern industry. Since 1900, the uses of concrete have multiplied a hundredfold.

Throughout the United States today, motor vehicles of every type roll smoothly over concrete roads whose mileage would reach nearly halfway to the moon. In cities, towns, and villages, people walk to work and to school on concrete sidewalks. Factories, schools, stores, and churches have concrete walls, floors, posts, and beams—strong, durable, and fireproof. Additional strength is often imparted by use of tough steel bars, buried in the mixture before it is placed in the forms for hardening. This process is called reinforcing the concrete. The Imperial Hotel at Tokyo, Japan, withstood the earthquake that wrecked the city in 1923, because it was built of reinforced concrete.

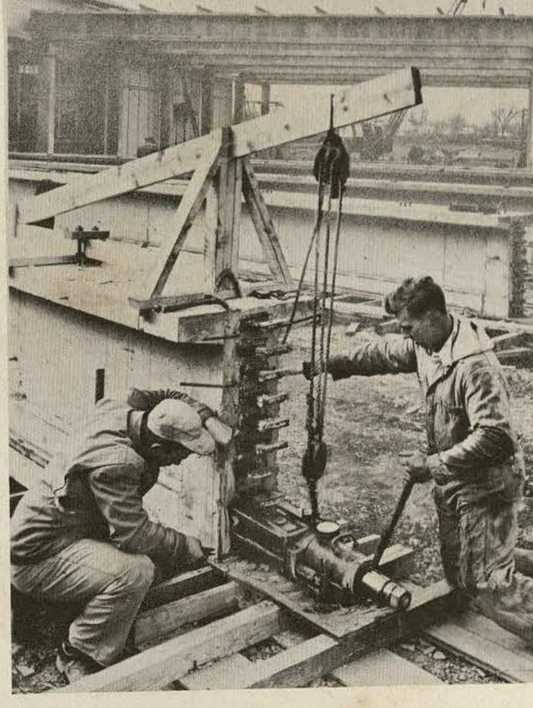
Then there are the great structures that make up our "public works"—bridges, runways for airports, sewers, water plants,





GARDEN SPOT

Nothing so enhances a garden's loveliness as a fountain pool. Concrete is adaptable to many variations of pool design, such as the one shown here (1). It is made of reinforced concrete, laid in a pit. Besides being ornamental, it provides room for fish or even small waders. The plan (2) shows how the water is brought in and drained off.



HOW COMPRESSION PUTS "SQUEEZE" ON PRESTRESSED CONCRETE

Above left, in one form of precompressing, rubber inserts are placed in the girder forms. Fresh concrete is then poured around them. Later, the inserts are removed and high-tensile strength steel wires are drawn through the holes. These wires are anchored at one end of the girder, fastened to a jack at the other end. Above, as the jack pulls on the steel wire, it exerts an inward push on the concrete at the same time. The great pressure causes the concrete to arch slightly upward, giving it great strength. Not only does prestressed concrete allow the use of long, unsupported sections, but also permits the use of lighter, shallower structures than ever before possible. Even hairline cracks in the concrete caused by overloads close immediately when the load is removed.

dams, canal locks, power houses, pipe lines, docks, flood walls, irrigation canals. Concrete enters into the making of all these structures, upon which depend transportation, industry, sanitation, and public safety. The world of sports and recreation uses concrete for swimming pools, tennis courts, and park ornamentation — fountains, sun dials, rock gardens, statues, and the like. On the farm we have concrete silos, tanks, fence posts, and many other structures requiring durable material. More and more concrete is being used for residential purposes in urban and rural sections alike. We truly live in the concrete age. See CEMENT, PORTLAND.

CONDENSA'TION. When gases or vapors in the air form a liquid, the process of condensation is taking place. Condensation simply means making something more compact, bringing its parts closer together. Steam, when cooled, condenses into a liquid. It ceases to be an invisible vapor composed of tiny particles of liquid and becomes a solid mass of particles which may be seen by the eye.

At a certain temperature, air can hold only a limited amount of water vapor. Warm air can hold more than cold air. When warm air is cooled, after a certain amount of water vapor has been taken up by a process called *evaporation,* it finally reaches a temperature where it can hold no more water vapor. This is called the *saturation point.* If air is cooled beyond that point, the vapor becomes so heavy that it forms small drops which fall from the air.

Frost and snow form when the temperature is very cold. Dew found on plants and the "sweat" drops on the outside of a glass of ice water are the results of condensation. See Evaporation.

Sound Waves. In physics, sound waves are composed of alternate *condensations* and *rarefactions*. At one part of the vibration resulting from a sound, the molecules of air are pushed together. This is known as condensation. In the next movement, rarefaction, the molecules spread out.

CONDENSED MILK. See Milk, Condensed.

CONDOR, *ḳon'dur.* Several of the largest birds of the vulture tribe are known as condors (see Vulture). The biggest one, which is probably not exceeded in size by any bird of the air, is the nearly extinct California condor, found only rarely in isolated places in California and Lower California. The most common and best-known condor is that of South America. It is a bird about four feet long and has a wing spread of from eight to eleven feet. The color of its plumage is black except for a white ruff around the neck and some white in the wings. The head and neck are bare, wrinkled, and reddish, and the male has a comb and wattles.

Condors live and breed in the high mountains, laying their two large, white eggs in rude nests of sticks, or on the bare rocks. The young are downy and helpless, do not fly for a year or so, and take a number of years to attain their adult plumage. Like all vultures, condors eat dead things but will attack sick and weak animals on occasion. They have disgusting habits of gorging themselves until they cannot take wing, when they are sometimes easily captured. But in the air they are masters of flight, few birds being more graceful and none soaring higher.

Copyright by Nature Magazine, Washington, D.C.

CONDOR CLEAN-UP SQUAD

Condors, like other vultures, help keep the outdoors tidy by eating dead animals. Sometimes they also swoop down from great heights to capture small game. The California condor is almost extinct.

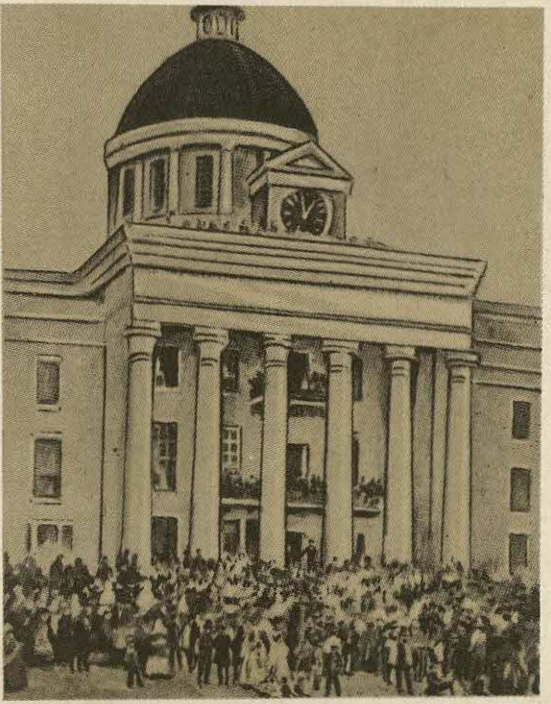
CONDUCTOR, Electrical. See Electricity.

CONE. Even a small child knows the shape of a cone, for he knows well the popular ice-cream cone. But the cone as used in the study of geometry is solid, not hollow. Its peak is known as a *vertex*, its circular bottom as a *base*.

The area of the sides of a cone, not counting the base, is the *convex surface*. It is found by multiplying the circumference of the base by half the slant height. To find the volume of a cone, multiply the area of the base by one third of the altitude (the perpendicular distance from the base to the vertex). The area of the base is determined in the same manner as the area of any other circle. See Circle.

CONE-BEARING TREES. See Conifers.

CONFEDERACY, United Daughters of the. This society was organized at Nashville, Tenn., in 1894, to keep alive the memory of all who honorably aided the Confederate cause during the war between the states. The society consists of direct female relatives and lineal female descendants of



CRADLE OF THE CONFEDERACY

Montgomery, Ala., was the seat of the Provisional Congress of the Confederacy which selected Jefferson Davis as President. Above, the first Confederate "White House," where Jefferson Davis lived in the early days of the war. Right, the inauguration of Davis, 1861, on the portico of the classic old Alabama Capitol. A brass star marks the spot where he stood and where Alabama governors take the oath.

those who fought for, or in any other way helped, the South during the four years of secession from the Union. Local chapters are governed by state divisions. These, in turn, are controlled by a general organization. The membership exceeds 36,000.

CONFEDERATE STATES OF AMERICA. Misunderstandings between the North and the South over the slavery question reached a crisis in 1860, following the election of Abraham Lincoln. The South believed its rights could not be protected by a President opposed to slavery. As a result, eleven states seceded from the Union and organized the Confederate States of America.

In his inaugural address in March, 1861, Lincoln addressed these words to the South: "In your hands, my dissatisfied fellow countrymen, and not in mine, is the momentous issue of civil war. The government will not assail you. You can have no conflict without being yourselves the aggressors. We are not enemies, but friends." Despite the efforts of prominent men on both sides to avert hostilities, four years of civil war followed, leaving the South prostrate.

South Carolina was the first state to withdraw from the Union. On December 20, 1860, about six weeks after Lincoln's election, delegates met in convention and passed an ordinance of secession. Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas soon followed the lead of South Carolina. Delegates from six of these seven states met at Montgomery, Ala., in February, 1861, to organize a new government.

Its Constitution followed closely that of the United States, with a few exceptions. For instance, it forbade the imposition of a protective tariff; it upheld state sovereignty based on the provisions in the old Articles of Confederation; and it agreed that the "institution of negro slavery as it now exists in the Confederate States shall be recognized and protected." The terms of President and Vice-President were fixed at six years.

Jefferson Davis of Mississippi was elected President of the Confederacy, and Alexander H. Stephens of Georgia was elected Vice-President. Montgomery, Ala., served as the temporary capital.

During the year 1861, Virginia, Tennessee, Arkansas, and North Carolina joined the Confederacy, which now consisted of eleven slave states. The seat of government then was removed to Richmond, Va.

The question uppermost in every one's mind during the winter of 1861 was whether civil war or a peaceful division of the country would follow. Serious attempts were made to restore harmony both by the North and the South. As yet, the Confederate States had encountered no obstacles as an independent republic. They had taken possession of the national customhouses, forts, and military supplies within their states.

Major Robert Anderson, commander of Fort Sumter, on an island in Charleston Harbor, South Carolina, remained loyal to the Union. When this fort was fired on by the Confederates, April 12, 1861, the North was swept by the demand that the South be severely punished and brought back into the Union.

Desperate days followed. The army of the North greatly outnumbered that of the South. This disadvantage was partly overcome in the South by the employment of slaves in the raising of crops and as teamsters and laborers in the army. The North had many railroads and steamships to transport troops and it had war materials made in its foundries, mills, and factories. The South, which consisted largely of agricultural communities, had few industries and shipping facilities.

The banks in the North, as well as in foreign countries, were willing to make loans to the Federal government to enable it to carry on the war. The Southerners did not have this credit. Their only means of raising money was by selling their crops in European markets. But this source of revenue was soon almost entirely cut off by the blockade of the Federal navy.

In vain the South sought aid from England and Europe to break this blockade, but these countries refused to acknowledge the Confederacy as an independent government. The Confederacy finally was compelled to issue great sums in paper money, or government notes, and to exchange government bonds for provisions and ammunition. This practice led to almost unheard of increases in the prices of all commodities.

Against such overwhelming odds, the Southern soldiers fought valiantly to defend their cause. In spite of their efforts, however, the Confederate government ended with the surrender of the army of General Robert E. Lee at Appomattox on April 9, 1865. Richmond was taken by the Federal forces, and Jefferson Davis placed under arrest.

Each of the eleven Confederate States then again became a separate unit and was obliged to accept the terms of the Federal government before it was received back into the Union on an equal basis with the other states. By 1877, when the period of reconstruction was completed, Federal troops were withdrawn from the South. See CONFEDERACY, UNITED DAUGHTERS OF THE; CIVIL WAR IN AMERICA; SLAVERY.

CONFED'ERATE VET'ERANS, SONS OF. Founded at Richmond, Va., in 1896, the Sons of Confederate Veterans limits its membership to male descendants of the sailors and soldiers of the Confederacy during the War between the States. Its major concern has been the welfare and comfort of surviving veterans and their dependents. It owns and maintains as an historic shrine "Beauvoir," near Biloxi, Miss., the home of Jefferson Davis, the Confederacy's President. It purchased and began the restoration of Manassas Battlefield Park, now a national historic site, where the Battles of Bull Run (called Manassas by Southerners) were fought.

CONFEDERATE VETERANS, UNITED. Founded at New Orleans, La., in 1889, the United Confederate Veterans was organized to unite all other associations of Confederate veterans of the War between the States. It also aimed to preserve the friendships formed during the conflict

THE INFERNO THAT WAS GETTYSBURG

Most celebrated of Civil War battles, the three-day conflict near the town of Gettysburg was the turning point of the war. Lee had to retreat into Virginia, and the Confederate invasion of the North was repulsed. Gettysburg cost both North and South thousands of lives.

and to help the veterans and their dependents. Annual reunions continued while the organization's membership dwindled as one after another of the aged veterans "answered the last roll call."

CONFEDERA'TION, Articles of. During the Revolutionary War the thirteen American states were bound together by a "firm league of friendship" provided for in the Articles of Confederation. Each state had the power to retain its sovereignty, freedom, and independence. Long before the war was won, the colonists recognized the need of a stronger, more efficient central government if their Union was to survive.

Richard Henry Lee of Virginia proposed to Congress in June, 1776, that a plan of confederation be sent to the colonies. A committee composed of one member from each state was appointed to draft the Articles. A report was made to Congress the following month, but differences among the delegates in regard to states' rights delayed adoption until November, 1777. The Articles were then submitted to the state legislatures, as their unanimous consent was necessary for ratification.

Two years elapsed, and all the states except Maryland had signed the Articles. The legislature of Maryland refused to sign until the states agreed to her demand that they first cede to the Confederation their territorial claims in the Northwest Territory. When assurance to that effect was given, the Articles were finally put into operation in March, 1781.

The government was vested in the hands of a Congress composed of not less than two nor more than seven delegates from a state, although each state had but one vote. This provision the larger states resented. There

FOUNDATIONS OF CHINA'S FAITH

Old, even in a land of greatest age, Confucianism has millions of adherents in China. The religion was founded 2,500 years ago on the ethics of Confucius (right), one of China's first great sages. Above, a Confucianist temple in Peking.

were many points of weakness. Although Congress could settle disputes between the states, it had no power to regulate commerce or to raise revenue. It could declare war, but was not able to raise troops. It could pass laws, but could not compel their observance. It was given the power to make appropriations, but could not collect taxes.

These are but a few of the provisions which brought about a very critical condition. Laws were not respected, and life and property became insecure. The weak, decentralized government was, as Daniel Webster said many years later, "merely a rope of sand." As a result, the Constitutional Convention met in Philadelphia in 1787 to provide for "a more perfect Union" between the states. The Constitution of the United States, which is still in force, was drawn up at that time.

For the full text of the Articles of Confederation, write to Old South Meeting House, Boston, enclosing five cents.

CONFUCIUS, *kon fu'she us,* or **K'UNG FU-TZE** (551-478 B. C.). One of the world's great teachers and philosophers, Confucius lived in China about five hundred years before the birth of Christ. So great was his influence that even today the best Chinese student is he who memorizes the teachings of Confucius.

Confucius was born in the province of Shantung, in the ancient state of Lu. As a boy, he lived in poverty with his widowed mother. But in spite of hunger and hardships, he was well educated and learned to love the ancient literature of China.

When he was twenty-two years old, Confucius became a teacher. He gained a wide following, and even princes came to study under him. As the years passed by, he worked out the precepts, or proverbs, which formed the basis of his moral teachings. He did not intend to found a religion and did not consider himself divine. Nor was he concerned about a God or a future life here-after. His concern was for mankind in this life. He wanted men to live together in happiness and harmony and to observe rules of good conduct.

Reverence for parents was probably the most important of his teachings. It led to the deep-rooted conviction among the Chinese that ancestors must be worshiped, and it explains why progress in China has been so slow. A people cannot advance very rapidly when they continually look backward believing that what was good enough for their ancestors is good enough for them.

Confucius also taught that men should absolutely obey their superiors without question, and this teaching, too, has had a retarding influence on the Chinese. But he based the teaching on a belief that only honest and just men should hold public office.

A few of the sayings of Confucius are:

> What you do not wish done to yourself, do not do to others.
>
> The cautious seldom err.
>
> Learning without thought is useless. Thought without learning is dangerous.
>
> To see the right and not to do it is to be a coward.
>
> It is only the very wisest and the very stupidest who never change.

Although Confucius himself had no thought of founding a religion, his followers, after his death, worshiped him almost as a god. Temples dedicated to him appeared in every part of China. The religion established was known as Confucianism, and it became practically the state religion of China. The Chinese bible is composed of the *Five Books,* a compilation by Confucius of the ancient classics of China, together with the *Four Books* in which his followers recorded the lessons he had taught. The influence of Confucius continues to this day, when about 300,000,000 people of the Orient are guided by his philosophy.

As a holder of public office, Confucius practiced what he had preached to others. When he was fifty-two years old, he was appointed chief magistrate of the city of Chung-tu, in the state of Lu. Because of his fine record, he was later appointed minister of crime, and the prosperity of Lu became known throughout China. Then, at the height of his public career, he met opposition from a dishonest official and resigned. He was then fifty-six years old. Accompanied by a number of his faithful followers, he became a wandering teacher, self-exiled, for thirteen years. The last five years of his life were spent in retirement in Lu.

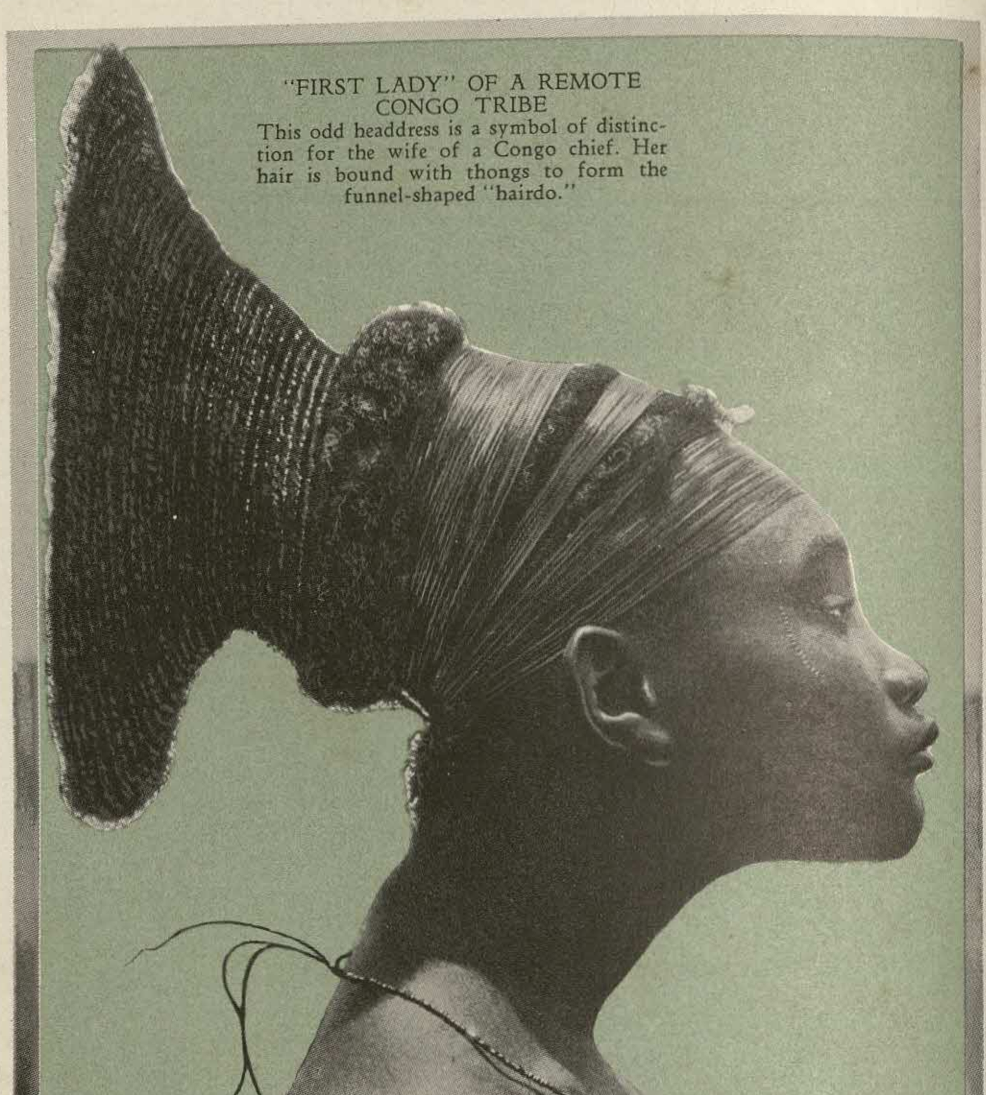
CONGO, *kong′ goh,* BELGIAN, the part of the region along the great Congo River which became Belgian in 1908. This region was divided between Belgium and France. The French part became known as French Equatorial Africa. Livingstone and Stanley were the great explorers who made the Congo region known to the world. The Belgian Congo became independent in 1960. See CONGO, REPUBLIC OF.

The People. Most of the people are of Bantu and Sudanese stock. There were fewer than 100,000 Europeans in the Belgian Congo before independence. Most of them have now withdrawn. Roman Catholic missionary activity has been great. Worship of fetishes and idols is a feature of the native religions.

Agriculture and Mining. The Belgian Congo was a rich colony. The region grows cotton, palm nuts, cocoa, rubber, and many other products. The forests are rich in mahogany and other tropical woods. Vast resources of minerals include copper, gold, silver, tin, radium, iron, tungsten, manganese, and the world's largest supply of industrial diamonds, cobalt, and uranium.

History. King Leopold II of Belgium engaged Stanley to negotiate with the tribal chiefs and to bring this vast region under his domain. It was his personal property until 1908, when Belgium annexed it and attempted to reform brutal treatment of the forced Congo laborers.

CONGO REPUBLIC is a republic on the South Atlantic formed from French Equatorial Africa. It is bounded by the republics of Gabon, Cameroon, Centrafrica, Republic of the Congo, and the colony of Angola. It became independent August 15, 1960. Its area is 132,000 square miles, and its population about 760,000. Its capital

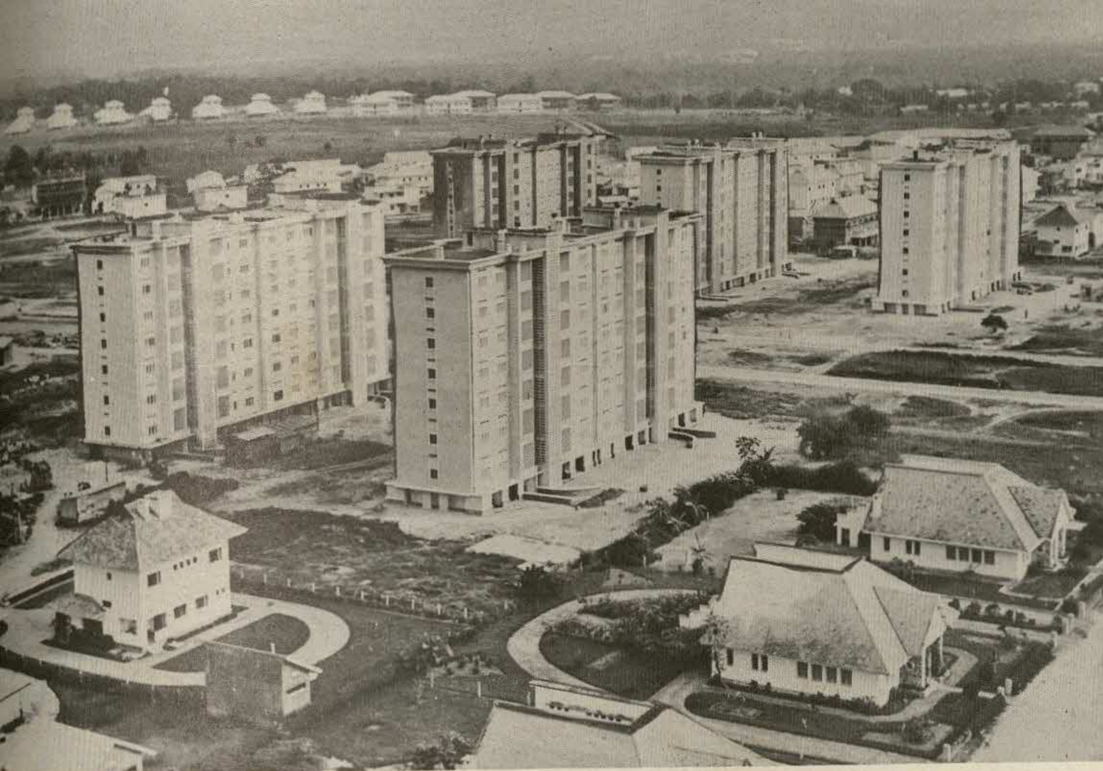


"FIRST LADY" OF A REMOTE CONGO TRIBE

This odd headdress is a symbol of distinction for the wife of a Congo chief. Her hair is bound with thongs to form the funnel-shaped "hairdo."

is Brazzaville. It has been self-governing since 1958.

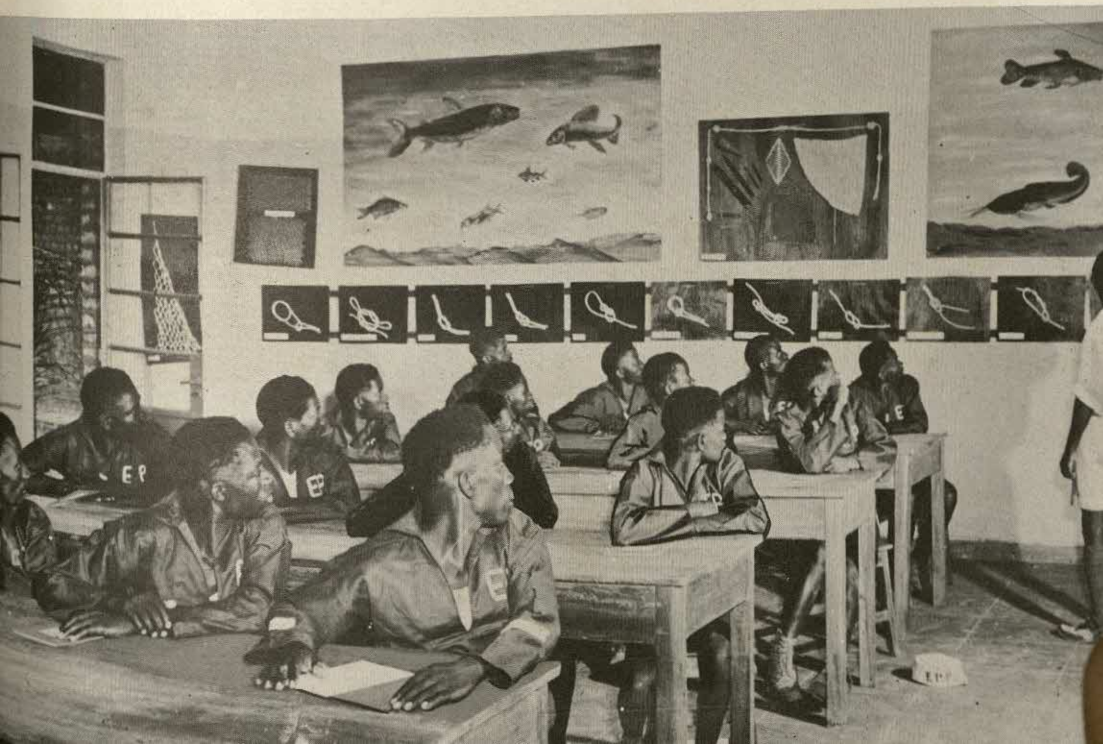
CONGO, Republic of, is a republic on the South Atlantic formed from the former Belgian Congo. It is bounded by the republics of Congo, Centrafrica, Sudan, and the nonindependent territories of Uganda, Ruanda-Urundi, Tanganyika, the Federation of Rhodesia and Nyasaland, and Angola. It became independent June 30, 1960. Its area is 904,757 square miles and its population is about 13,560,000. Its capital is Leopoldsville. Elizabethville is a large city, and Banana, Boma, and Matadi are chief ports. There are many miles of railroads and roads. The Congo River is a great means of transportation. Airlines also serve the Republic.



United Press

THE CONGO EMERGES FROM THE JUNGLE

Progress marches along in Africa. Modern apartments and houses replace jungle huts near Leopoldville, Belgian Congo, and cement sidewalks cover dirt paths. Below, an instructor uses drawings to teach modern fishing techniques to students in a fishing school in the Congo.



CONGO RIVER. Like a giant, shimmering highway leading from the very heart of the continent to the Atlantic flows the great Congo, largest river in Africa and second in length only to the Nile among African rivers. Springing up in a wild mountain section between lakes Tanganyika and Nyasa, it suddenly veers to the southwest as the Chambezi River, flowing into Lake Banguelu in Northern Rhodesia. All along its upper course are found crocodiles, elephants, gorillas, and other wild animals, for here, truly, is the "Big Game Hunter's Paradise" of Africa.

From Lake Bangweolo it suddenly turns north as the Luapula, which empties into Lake Moero. Along this part of the route the river is broken by innumerable waterfalls, making navigation impossible. After leaving Lake Moero, the river is known as the Lualaba. From that point it follows a northward course to Stanleyville, picking up many small tributaries on the way and broadening into a sweep of smooth water, in many places over a mile wide. Along its heavily wooded banks may be seen the fertile patches of ground under cultivation by the native blacks. Just before Stanleyville, the traveler comes suddenly upon Stanley Falls, consisting of seven cataracts along a sixty-mile curve of the river. These falls, although totaling a drop of only 200 feet, are sufficient to hinder navigation, and a railroad has been built around them for the transfer of cargoes.

Reaching Stanleyville, the river broadens into the Congo. From Stanley Falls to Stanley Pool the river is free for navigation, but just below Stanley Pool is another cataract. Navigation is free from the mouth of the river inward for a distance of only about ninety-five miles.

In spite of the fact that the Congo is broken by innumerable falls and rapids throughout its length of 3,000 miles, it is the outstanding artery of Belgian Congo traffic for a distance of 1,500 miles, and large steamers ply its upper course as far as navigation is possible. Chief among the cities to be found along it are Banana, Leopoldville (the capital of Belgian Congo), Matadi, Boma, and Stanleyville. It was first thoroughly explored by David Livingstone, who got as far as Lake Bangweolo in 1868. Eight years later, Henry M. Stanley entered the upper regions of the Congo from Zanzibar and, by a series of marches through the jungle, brought the world a complete knowledge of the source of the upper Congo. See CONGO; STANLEY; LIVINGSTONE; AFRICA.

CONGREGATIONAL CHRISTIAN CHURCHES, THE. Members of the Congregational Christian Churches believe that every group of people worshiping together as Christians should be an independent body. Consequently, each Congregational organization has the right to elect its own officers, discipline its members, and decide upon its own form of worship. The church does not have to account to any higher authority, such as a bishop or conference of several churches, in the conduct of its affairs. The members of the church pay all expenses by voluntary offerings.

The Congregational Church was formed in England by a group which broke away from the Church of England. The members were at that time called Separatists. It was to this group that the Pilgrims on the *Mayflower* belonged, and it was the Pilgrims who introduced Congregationalism in America in 1620. The Congregationalists in England are now known as Independents.

In the United States today, all the individual churches of each state are organized into a state association. These state groups send delegates to meet together in a national council every three years.

The Congregationalists have always stood for higher education, and among the colleges and universities they have founded are Yale, Dartmouth, Amherst, and Oberlin. In 1931 the Congregationalists combined with members of the Christian Church. The Congregational Christian Church has 1,284,000 members in the United States and a worldwide membership of 2,400,000.

CONGRESSIONAL, *kon gresh'unal,* **LIBRARY.** See LIBRARY OF CONGRESS.

CONGRESSIONAL RECORD. A complete record of the proceedings of the Senate and House of Representatives of the United States Congress is published daily during each session. Every word officially spoken in the Senate and House is recorded by a force of expert stenographers. Each reporter is on duty for an hour at a time, after which he retires to transcribe his notes for the printer. In one sense, however, the publication is not an accurate transcript of proceedings, since Congressmen not permitted to extend their remarks unduly on the floor are given "leave to print"—that is, accorded permission to have their speeches appear in full in the *Record*.

The *Record* is printed during the night at the Government Printing Office, and is placed the next morning on the desks of the members of Congress and government officials. Each member of Congress receives free fifty copies of the publication for distribution. The *Record* is sent free to public libraries and to daily newspapers, on request, and may be purchased by the public at a price which does not exceed the cost of production.

CONGRESSMAN-AT-LARGE. Every ten years, after the regular Federal census, Congress determines the number of members in the House of Representatives. Congressional districts are based on the total population in each state, and each district is entitled to one Representative. If it happens that, under the new apportionment, a state is entitled to another Representative, it need not wait until new congressional districts are formed. Instead, all the voters of the state as a whole may elect a Congressman-at-large. Eventually the electoral districts are reapportioned and the additional Representative is then elected by the voters of his district.

CONGRESS OF MOTHERS, NATIONAL. Many of the advantages enjoyed by the children of America today can be traced directly to the National Congress of Mothers. This group, composed of parents, clergymen, congressmen, and educators, met for the first time in Washington, D. C., in February, 1897. Led by Mrs. Theodore W. Birney and Mrs. Phoebe A. Hearst, the meeting was called to plan a program for improving the condition and prospects of the children of America.

At that time a constitution was adopted explaining the purposes and aims of the Congress of Mothers. These aims were many and varied. They included not only the raising of the general standards of children's home life, but also closer co-operation between parents and teachers. It was hoped that "Young America" would thus receive a helpful useful education for the years ahead and so develop into good citizens.

The Parent-Teacher Association. To carry out this program, there sprang up all over the country a great number of Parent-Teacher Associations. These associations were successful from the start. They not only enabled the teacher to get a better picture of the home life of the child, but gave the parents a better idea of how the schools were conducted, how tax money was spent, and how teacher and parent could best work together for the interest of the child. As a result of these associations, a wholesome, friendly spirit of "teamwork" has sprung up among teacher, parent, and child in the school and home.

How Meetings Are Conducted. Meetings of each association are held in the community at least once a month, at which time both parents and teachers may give short talks according to a pre-arranged program. Plays are often given to raise money for the association; short plays and dances by the children are usually a part of the program; and any misunderstandings or difficulties between the school and the parents are peaceably settled.

A New Association. In 1924 the Parent-Teachers Associations and the National Congress of Mothers merged to form what is now known as the National Congress of Parents and Teachers. See PARENTS AND TEACHERS, NATIONAL CONGRESS OF.

UPI

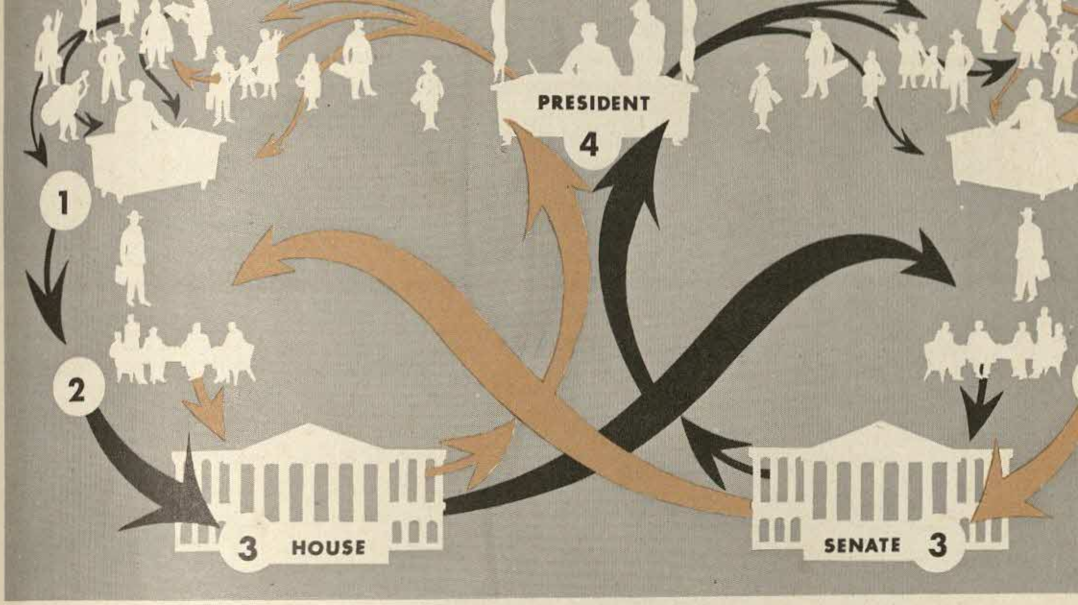
SPECTATORS PACK GALLERIES FOR JOINT SESSION OF CONGRESS

Early each year, the Senate joins the House of Representatives in the south wing of the Capitol for the President's "State of the Union" message. The two bodies also meet jointly when national emergencies arise. Normally, such meetings are limited to joint committees, named by both houses to iron out major differences of opinion on important legislation.

CONGRESS OF THE UNITED STATES. The town meetings of the later colonial days provided a model for the framers of the American Constitution when they wrote the provisions for a Congress, or national legislative body. These meetings were assemblies of men who represented the people of the towns and were authorized to carry out their wishes. Based on the same democratic principle, the present Congress of the United States is a national assembly of men elected by the people of the United States to make laws for them. It is divided into an upper and a lower house, called the Senate and the House of Representatives.

Each Congress is known by number, and the length of each is two years, coinciding with the terms of the members of the House of Representatives. Originally, the life of each Congress began on March 4 of odd-numbered years, but through the adoption of the Twentieth Amendment, in January, 1933, Congress begins on January 3rd.

The Senate. The upper house of Congress has been called "the most powerful deliberative body in the world." Its powers are specified in the Constitution. In addition to enacting laws as a branch of Congress co-ordinate with the House of Representatives, the Senate sits as a court of law in trying cases of impeachment against Federal officers, including the President, when their impeachment has been voted by the lower house. The Senate also shares with the Chief Executive treaty-making powers, and it is authorized to confirm certain appointments made by him, such as those of Federal judges, ambassadors, and Cabinet members.



HOW A BILL BECOMES A LAW IN CONGRESS

A bill, based on public needs or public pressure, may be introduced by either a Representative or a Senator (1). It goes for study to a Standing Committee (2), which reports it to the House or Senate (3). After a favorable vote, a Senate bill is sent to the House and a House bill to the Senate for final passage (cross-over arrows). The President's signature (4) makes it a law.

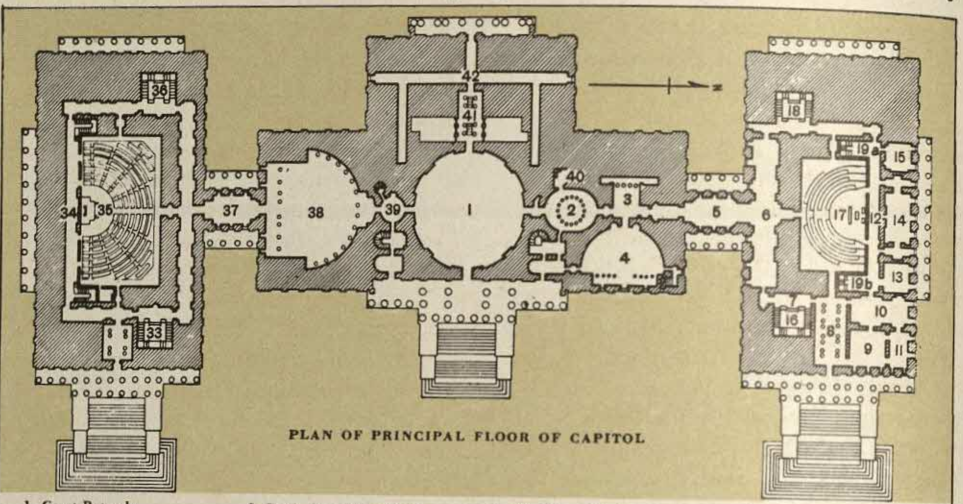
The Constitution provided for two Senators from each state, and the number is now one hundred. Each Senator is elected for a term of six years. Every two years the terms of one third of the members expire and new elections are held; thus the Senate is "always changing but forever the same."

Prior to the adoption of the Seventeenth Amendment, in 1913, state legislatures elected Senators because the framers of the Constitution thought that the Senators should represent the states. Now each Senator is elected by the direct vote of the people of the state in which he lives. Senators may be re-elected as often as the people wish to retain them.

A Senator must be thirty years of age, a citizen of the United States for nine years, and an inhabitant of the state electing him. Senators draw a salary of $22,500 a year. The Vice-President of the United States, the Senate's presiding officer, gets $35,000 a year and $10,000 for expenses, all of which is taxable.

The House of Representatives. The House and Senate have equal authority in enacting all legislation, but because the members of the House are considered closer to the people, they alone have authority to originate bills for raising revenue, such as those pertaining to taxation. Representatives also are authorized to prefer charges of impeachment and to refer such cases to the Senate for trial.

Under the Constitution, the House decides for itself how large its membership shall be. The number of Representatives is apportioned among the states according to population, and each state is entitled to at least one Representative, regardless of its population. After each decennial census, the number of members for the next decade is decided upon, and the population of the country is divided by this number. The basis of apportionment is thus determined. Each of the states is usually divided into as many districts as it has Representatives. There are 437 members in the House as now constituted. The number for each of the states ranges from one, in Alaska, Delaware, Hawaii, Nevada, Vermont, and Wyoming, to forty-three for New York, the



PLAN OF PRINCIPAL FLOOR OF CAPITOL

1. Great Rotunda
2. North Small Rotunda
3. Supreme Court Foyer
4. Supreme Court Chamber
5. Arcaded Passageway
6. South Corridor
7. East Corridor
8. East Elevator Foyer
9. D. C. Committee Room
10. Public Reception Room
11. Sergeant-at-Arms' Room
12. Senate Lobby
13. Vice-President's Room
14. Marble Room
15. President's Room
16. East Grand Stairway
17. Senate Chamber
18. West Grand Stairway
19a. 19b. Senators' Stairways
33. East Grand Stairway
34. Speaker's Lobby
35. Representatives' Chamber
36. West Grand Stairway
37. Arcaded Passageway
38. Statuary Hall
39. South Small Rotunda
40. Stairway to Dome
41. West Stair Hall
42. Library Corridor

This floor plan shows important chambers and rooms of the Capitol. Left, is the House wing, reserved for Representatives, while at the right is the Senate wing. The office buildings of the legislators are connected with the Capitol by underground passageways.

most populous state in the Union.

Every Representative is elected for a term of two years. Because the members of the lower house must give an accounting to the voters more frequently than the Senators, they are supposed to react more quickly to the wishes of the people.

Representatives must be at least twenty-five years old, citizens for at least seven years, and residents of the states from which they are elected. By unwritten law, they must also be residents of their districts. They get the same pay as Senators. The presiding officer of the House, the Speaker, who is elected by the House, gets the same salary as the Vice-President, $35,000 with a $10,000 expense allowance.

The House has the sole power of originating revenue bills, though the Senate may amend them. It is also authorized to impeach Federal officials.

How Congress Functions. The first business of a new Congress is the appointment of committees. Every Congress is confronted with thousands of bills of more or less urgent nature. To handle this mass of legislative material would be impossible without the preliminary work of committees of convenient size. Whenever a matter is taken up by the entire House, that body is said to act as a "committee of the whole." There are from thirty to fifty standing committees in each house of Congress. The principal committee in the Senate is that of Foreign Affairs. That of Appropriations is almost equally important. In the House, the Ways and Means Committee and the one on Rules are probably the most important. All bills for raising revenue are handled by the committee on Ways and Means. Special committees of investigation and research are often authorized by the two houses.

The passage of a bill through Congress follows a fairly definite procedure. After any member in either house introduces a bill, its title is announced by the clerk and it is referred to the appropriate committee. If the nature of the bill warrants it, open hearings are held, and persons interested in the proposed legislation are called upon or permitted to express their views concerning it. Sometimes the committee "pigeonholes" a measure, or "buries it in committee." If the committee reports favorably on the bill, the entire text is read, and it is then open to debate, during which changes which are known as amendments may be made by majority vote of the body. Then follows the third reading of the bill — usually formal and by title only — and the final vote.

When a bill is passed it is sent to the other house. If there amended, it must be voted on again in the original house in its new form. If the two houses cannot agree on the changes, it is sent to a conference committee of Senators and Representatives. After the bill is passed by both houses, it is sent to the President, who may sign it, in which case it becomes a law; he may veto it, or he may "pigeonhole" it, letting it become a law after ten days without his signature unless Congress adjourns within that time. A bill vetoed by the President is returned to Congress, which may pass it over the President's veto by a two-thirds vote in both houses.

All of the proceedings in the two houses are reported and published in the *Congressional Record*. Speeches, bills, and debates are preserved there, making it possible for Congress to keep track of all that has taken place during each session.

The two branches of Congress have many offices that are controlled for the most part by the political party in power at the time. In the House of Representatives, the presiding officer, or the Speaker, is elected by that body at the opening of each Congress. He enforces the rules of the House, appoints the chairman of the committee of the whole, and signs acts. The majority leader, who is second in importance to the Speaker, is elected by caucus of the party in power. The minority party in the House also has a leader, usually its candidate for Speaker. He states his party's policies and appoints committee members.

Both houses have majority and minority "whips," who keep in contact with the individual members and work to quell any opposition to the party policies. There is also a secretary of the majority party who supervises all floor activities, such as speeches and debates, and distributes bills and amendments. The secretary of the minority performs these duties in the absence of the majority secretary.

Meeting Places. Both houses of Congress hold their sessions in the Capitol at Washington, D. C. In the south wing of the vast Capitol building is the large Hall of the House of Representatives. The Senate occupies a smaller room in the north wing. Whenever both houses hold a joint session to hear a message from the President, they meet in the south wing.

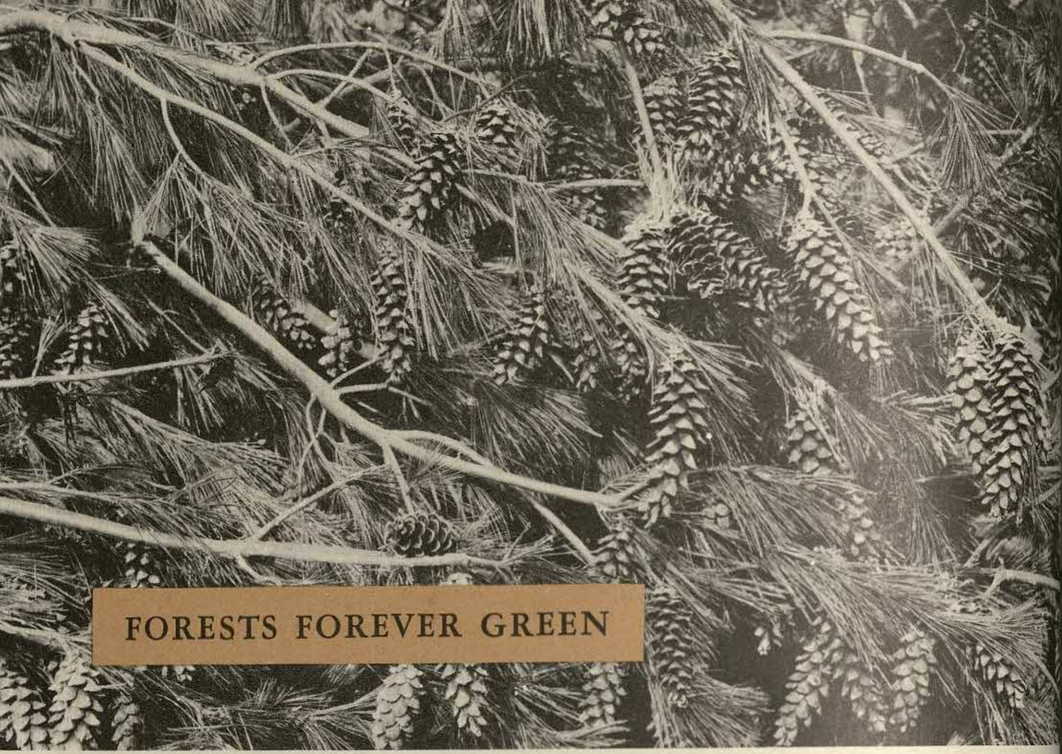
When Congress is in session the Capitol is a busy place. In the Hall of the House, members occupy seats arranged in a large semicircle. While the members listen to continuous speeches from the speaker's stand, clerks are busy taking notes, page boys are carrying messages and books to and from the libraries, newspaper correspondents are reporting the proceedings, and the galleries are filled with visitors watching a part of their government in action.

The Senate in session is a more dignified body. Each Senator is provided with a desk, many of which belonged to great statesmen of the past, and consequently have great historical value. Two interesting traditions of the Senate are the snuffboxes which date back to Henry Clay's time, and the sand dusters which were used before blotting paper was invented.

Near the Capitol are three buildings in which the Senators and Representatives have their offices. Here they write their speeches, keep their records, and correspond with the people whom they represent. Between the Senate Office Building and the Capitol there is an underground electric railway for the use of the Senators.

Consult the following titles for additional information:

Civil Government
Congressional Record
Constitution of the United States



FORESTS FOREVER GREEN

U.S. Forest Service

CONIFERS, *ko'ni furz,* **or CONE BEARERS.** Growing in north and south temperate regions is a large group of evergreen trees and shrubs which bear a peculiar cone-shaped, scaly fruit. For this reason, they are known as conifers, the word being derived from the Latin for *cone-bearing.* The cones vary in size in different species. Those of the hemlock and California redwood are less than three-quarters of an inch long; some of the pines of the Rocky Mountains and along the Pacific coast have cones two feet long and one-half foot thick. However, not all cones are woody. Some, like those of junipers, are fleshy and berrylike.

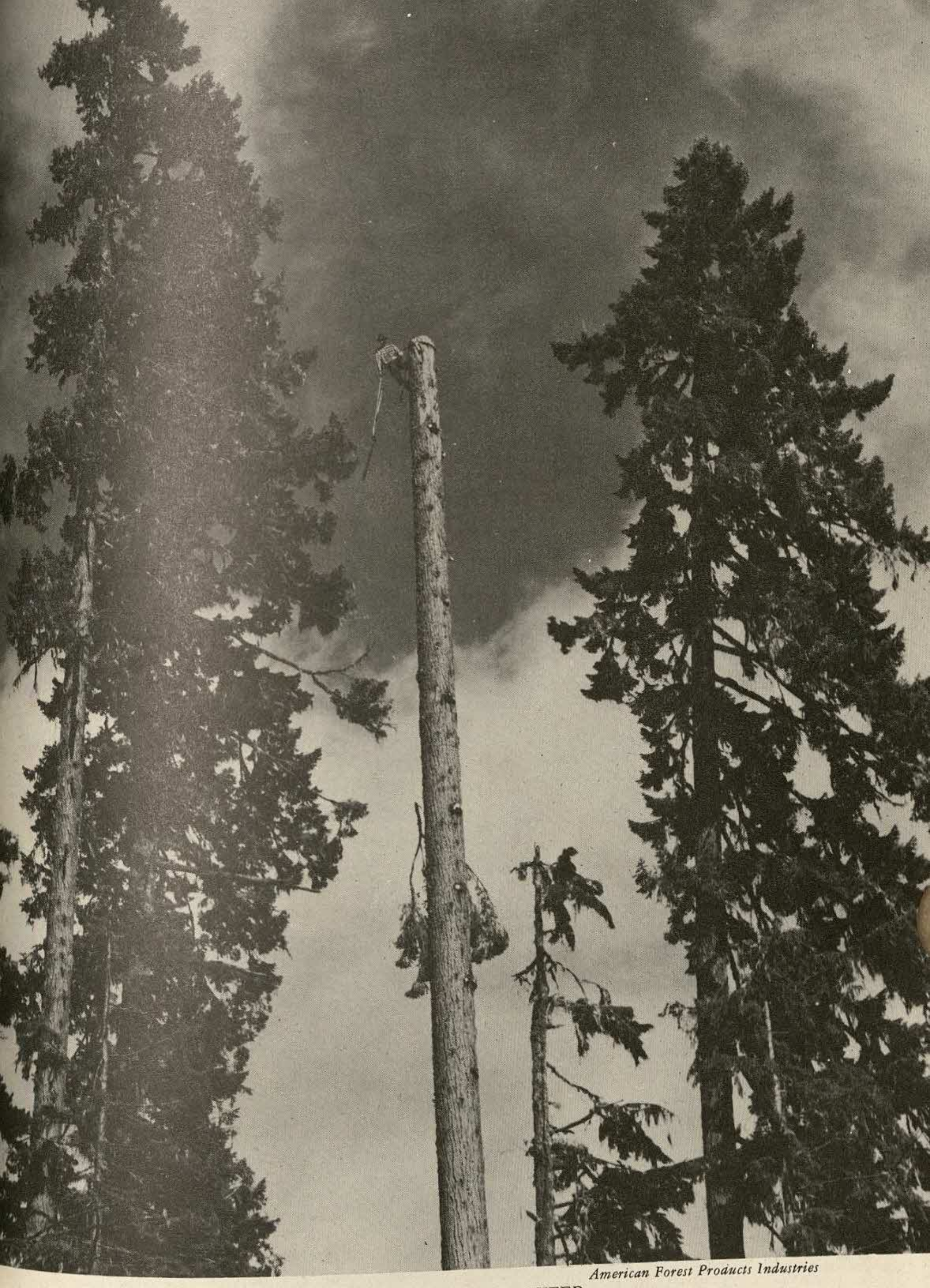
The trees of this group also have a conelike appearance. Their branches grow out horizontally and decrease in length gradually to the top. Because of their uniform habit of growth and their slender, needlelike leaves, many varieties are grown in gardens for decorative effect.

It is in the lumber industry, however, that they are of greatest value, especially pines, spruce, Douglas fir, California redwood, and some cedars. Their wood is light and durable and readily lends itself to many uses. These trees also yield large quantities of resin, turpentine, pitch, and tar.

Conifers are generally grouped into two families—the *Pinaceae,* or true pines, composed of heavy scales under which the seeds are borne; and the *Taxaceae,* consisting of the yews and related species.

Most of these trees are known as evergreens, because their leaves have no regular period of falling and the trees are clothed with them throughout the winter. However, there are exceptions, as in the bald cypress and larch, which shed their leaves like other deciduous trees.

In some species of these cone-bearing trees, the seeds ripen very slowly, and the scales hold firmly together until the seeds are ready for release, when the scales open. The stamens are borne in little cones which fall as soon as the pollen has been carried off by the wind. This pollen is light and powdery. It is wafted from tree to tree to effect fertilization. Some species have been widely scattered, and others are found in abundance only in certain regions.



American Forest Products Industries

TOPPING A GIANT CONIFER

This tree shorn of its branches will be used as a spar tree for logging operations. Most of the wood we use comes from cone-bearing trees.

CONJUNCTION, *kon junk'shun.* Words, phrases, clauses, and sentences are connected by a part of speech known as a *conjunction.* The term comes from two Latin words which mean *to join with.* There are two kinds of conjunctions: coordinate and subordinate. The former joins together similar elements, as "It was beautiful to watch the sun setting *and* the moon rising over distant hills." A subordinate conjunction connects a dependent clause with the main clause of a sentence, as "They could not see the sunset *because* the fog was heavy." Conjunctions used in pairs, as *not only—but also, neither—nor, both—and,* are *correlative* conjunctions.

CONNECTICUT, *kon net'i kut.* One of the thirteen original colonies, Connecticut might well be called "the State of Many Names." Its true name comes from the Connecticut River, called by the Indians *Qua-na-ta-cut,* meaning *long river* or *river of pines.* It has often been referred to as "the Land of Steady Habits," a tribute to its original thrifty Yankee population. Today it is still popularly called "the Nutmeg State" because of a story that, in the early days, not-too-honest Connecticut traders made and sold wooden nutmegs to unsuspecting housewives.

Geography. As it is in the hilly section of New England, one might expect Connecticut to be difficult to farm. On the contrary, however, Connecticut contains some fine farm land; and, although agriculture is not the leading industry, it has played an important rôle in the development of the state.

Although Connecticut is a small state of only 5,009 square miles, it presents an amazing variety of surface features. The state as a whole is definitely hilly, the highest parts being in the western areas traversed by the Berkshire Hills. It is this section, drained by the Naugatuck River and its tributaries, that carries the great manufacturing burden of the state. For in this great stream, innumerable waterfalls make power for manufacturers a minor problem. A number of low mountains are to be found here, the highest being Bear Mountain with an altitude of 2,355 feet.

In the Connecticut River Valley, the land is unusually level and ideal for farming. In the eastern uplands, one finds much the same conditions as in the western uplands. The Thames, however, does not furnish the abundance of water power given by the Naugatuck, although this region, too, is a manufacturing center. All these rivers empty into Long Island Sound.

Climate. Like other New England states, Connecticut has hot summers, cold winters, and an abundance of rainfall. On the slopes of the western parts of the state, the winters are unusually severe and the snows deep. Yet, in spite of these extremes, the climate is healthful.

Agriculture. As one might expect, typical temperate crops are raised here, chief among them being tobacco; much of the crop is used for cigar wrappers and binders. Corn, hay, potatoes, and oats are other important crops. Dairy and poultry farming, however, yield most of the farm income.

Mineral Resources. Connecticut cannot lay claim to rich mineral deposits, although brownstone is quarried in considerable amounts near Middletown. Feldspar, marble, granite, and limestone are also found in lesser amounts. Surprising as it may seem, iron mining has been carried on in Connecticut since 1732. Small amounts of cobalt, nickel, lead, and other metals are present, but not in paying quantities.

Transportation and Industry. Bounded on the north by Massachusetts, on the east by Rhode Island, on the west by New York, and on the south by Long Island Sound, Connecticut is ideally located for both industry and transportation. The Connecticut River, which bisects the state from north to south, is navigable for steamers as far as Hartford, and smaller craft can make their way even farther. Another river, the Thames, is navigable as far as Norwich. Numerous inlets on the coast furnish good harbors, among them New London, New Haven, and Bridgeport. In addition to water transportation, Connecticut has fine

Conn. Development Commission

SHAKESPEARE THEATER AT STRATFORD

Every summer since 1955 the American Shakespeare Festival Theater has presented the plays of Shakespeare, American style. Audiences in the flag-decked building have seen such stars as Katharine Hepburn play Viola in "Twelfth Night," and other roles. Associated with the theater is a year-round Shakespeare Academy.

Conn. Development Commission

CONNECTICUT TOBACCO IN SHADE

Cheesecloth tents cover a field of shade-grown tobacco in the Connecticut Valley. The plants, transplanted to the fertilized field, need careful cultivation. When marketed, this smooth fine tobacco will be used for the outside wrappers of cigars. Only shade-grown tobacco fills this need and it flourishes here.

railways and several thousand miles of superb highways.

Most of the people of Connecticut are dependent upon manufacturing for their living. Consequently, the greater part of the population lives in cities. More than one third the total population of about 2,535,000 live in Hartford, New Haven, Bridgeport, and Waterbury.

Metal manufactures are especially important. They include copper and brass products, airplane engines, office machines, watches and clocks, pins and needles, firearms, silverware, and hardware. Hats, rubber goods, and textiles are other important manufactures. It is interesting to note that the towns of Mansfield and Windham originated the silk industry in America, and the first silk mill sprang up in Mansfield early in the eighteenth century. At New London, on the Thames, shipbuilding has become an industry of great importance. Hartford and Bridgeport specialize in small automobile parts and ball bearings. Much of Connecticut's importance in manufacturing is due to the presence of cheap water power.

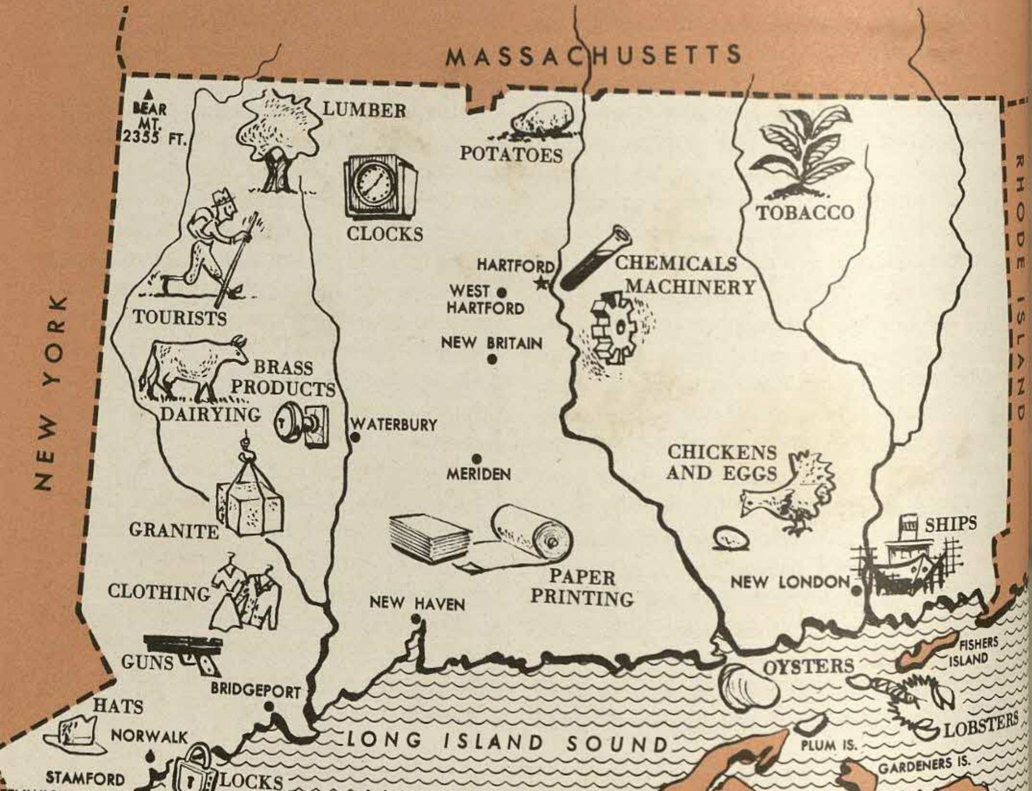
Education. Connecticut is fortunate in having fine public schools, normal schools, and universities. Normal schools and teachers' Colleges are located at Danbury, New Britain, New Haven, and Willimantic. Yale University is located at New Haven. Connecticut State University at Storrs, Wesleyan University at Middletown, Trinty College at Hartford, and the Connecticut College for Women at New London are other outstanding institutions of higher learning.

State supported institutions include mental hospitals at Middletown, Norwich, and Fairfield; a school for the deaf at Mystic; a school for the blind at Hartford; training schools for mentally handicapped children at Mansfield and Southbury. The state also maintains a veterans home at Rocky Hill and five sanatoriums for tuberculous patients.

Government. Dating back to the time of Thomas Hooker in 1636, Connecticut has one of the oldest governments in America. Its first constitution was adopted in 1639 and confirmed by Charles II in 1662. It was not until 1818, however, that it was replaced by a state constitution. The general assembly, which normally meets in the odd-numbered years, is composed of a senate and a house of representatives, whose members are elected for two-year terms. The state's chief executive officers, a governor and a lieutenant-governor, are elected for terms of four years. Its five supreme-court justices are appointed for eight-year terms.

History. The Dutch built a trading post near present-day Hartford in 1633, but English colonists from Massachusetts had already settled at Windsor and Wethersford and all the land between Narragansett Bay and the Pacific had been granted to a group of Englishmen by the British Crown. Expeditions set out, and a small English settlement was soon founded at Saybrook. It remained for Rev. Thomas Hooker really to attempt serious settlement when he led his flock to Windsor, near Hartford, in 1636. Other settlers followed, and New Haven was founded in 1638 by the Puritans, after the founding of Massachusetts Colony.

Connecticut played an active part in the French and Indian Wars, following a struggle with the king for a charter. A royal governor, Andros, appeared in 1687 and demanded the charter; but it was hidden away in an oak tree and did not reappear until later. In the Revolution, Connecticut furnished 30,000 soldiers. During the war, Connecticut suffered repeated raids on its defenseless towns, the last being led by the traitor, Benedict Arnold, in 1781. Connecticut was bitterly opposed to the War of 1812 and figured prominently in the Hartford Convention of 1814. For a long time, Hartford and New Haven were joint capitals, Hartford becoming the sole capital in 1873. See HARTFORD.



CONNEC'TIVE TISSUE. The various organs of the body are formed of tissues, and among these is the kind known as connective. It is the most widely distributed of all tissues, being used primarily to unite and support other tissues. It is found in the bones, ligaments, and cartilages, and forms the framework for nervous, muscular, and glandular tissues. The brain and spinal cord consist of connective tissue holding the nerve cells in place. See TISSUE.

CON'RAD, JOSEPH (1857-1924). Famed as an English novelist, Joseph Conrad was born December 6, 1857, in Poland. His ability to learn foreign languages and his long experience at sea were two things responsible for his success as a writer.

Although Polish was his native tongue, he learned, when still a young boy, to speak and write French. At the age of seventeen, he began an apprenticeship on French ships in the Mediterranean. Several years later he began serving on British ships and rose from able seaman to master. He learned English rapidly and adopted it as his own language.

The sea is the setting for most of Conrad's novels. Strangely enough, however, he was annoyed when called "the Novelist of the Sea" because his chief interest was people. Reading Conrad's works is a great satisfaction, for he always wrote forcefully of definite situations, at the same time writing artistically. He was a master of the English language.

His first novel, *Almayer's Folly,* appeared in 1895. Among his other books are: *An Outcast of the Islands, The Children of the Sea, Lord Jim, Typhoon, The Mirror of the Sea, Chance,* and *Under Western Eyes,* which is considered by many critics his masterpiece.

After having suffered ill health for several years, this great writer died in 1924 at the height of his career.

CONSCRIPTION, *kon skrip'shun.* It is a generally accepted principle that a government which protects and defends its people may conscript the man power of the country when the government itself is imperiled. Conscription is the compulsory enrollment of citizens of specified ages for army service. Nearly every great power in the world has a permanent system of compulsory military service, by which a large army is constantly maintained and the man power of the country is trained to bear arms. In time of war, men in civilian life are called to the colors as needed. Every male citizen must undergo military training for a specified period, and hold himself in readiness for active service.

Since their peoples are traditionally opposed to this system of so-called universal military service, the English-speaking nations have tended to keep military service voluntary unless war or some other serious emergency has seemed to require conscription. During World War I, for example, Britain delayed conscription until 1916; Canada, until 1917. However, Britain started conscripting men for its army soon after the outbreak of World War II, and was later empowered to draft women. Although the Canadian goverment had wide authority over manpower from 1940 until the end of World War II, it was only after 1942 that it could send drafted men abroad.

In the United States, men were drafted during the War of 1812, the War between the States, and World Wars I and II. In 1940, under threat of World War II, Congress passed the nation's first peacetime draft law. Under the Reserve Forces Act of 1955, youths who do not enlist as Ready Reservists are eligible for the draft.

CONSERVATION, *kon sur va'shun.* The average person is still prone to think of conservation as some big movement afar off from himself, though agreeing in general that its motives are worthy. Yet not until we learn to apply its principles in our daily, individual activities will true conservation become an effective reality. For it is the mass of individual acts that creates the general tendency. If many persons burn more coal than they really require or fail to sift the ashes, it means greater demand on the mines. If in our homes we thought-

Canadian Government Travel Bureau

CONSERVATION

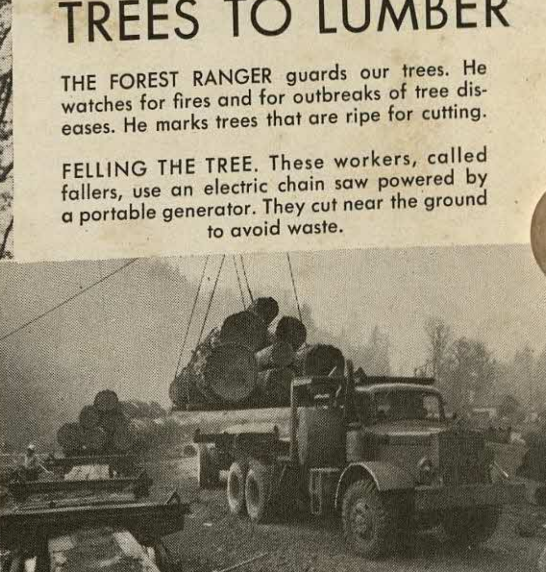
Exciting to catch, delicious to eat, this brook trout grew to full size because it was protected by conservation laws and practices. State and national laws and international treaties safeguard our game and food fish.

John Hancock Mutual Life Insurance Co.;
Weyerhaeuser Timber Co.

TREES TO LUMBER

THE FOREST RANGER guards our trees. He watches for fires and for outbreaks of tree diseases. He marks trees that are ripe for cutting.

FELLING THE TREE. These workers, called fallers, use an electric chain saw powered by a portable generator. They cut near the ground to avoid waste.



POWERFUL TRUCKS haul the logs from the tree farm to the sawmill.

Advertising Council, Inc.

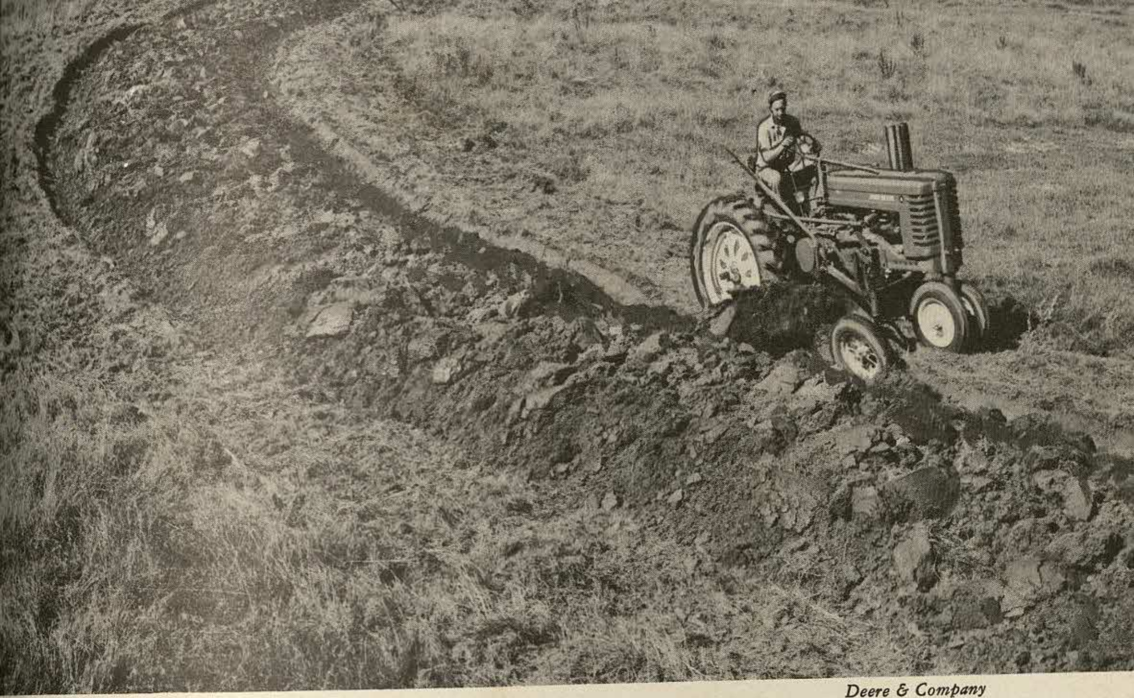
SKELETONS OF WASTED WEALTH

Every year fire destroys many thousands of acres of timber in the United States. Insects, wind, and disease also ravage the forests.

lessly consume oil, gas, or electricity beyond our needs, we create an added drain on the sources of supply. If here, there, and everywhere, men cut up good lumber for kindlings or destroy old magazines and newspapers, it means another, and still another, forest cut down.

If we neglect our health and so are ill or physically unfit a good share of the time, we are depriving the world of strength and service that it needs. Even though we personally can afford the expense of these wastes and wrong practices, the nation as a whole cannot afford the resulting drain on its resources, and we have no moral right to ask it to do so. This is the keynote of conservation: that each of us shall use thoughtfully and carefully the blessings that are ours, remembering the common good and the rights of generations yet unborn.

The Conservation Movement in America. America is the world's most striking example of rapid development and of prodigal waste. The United States has gone farther in a hundred years than older countries did in a thousand years. Not altogether



Deere & Company

TERRACING PROTECTS SOIL

Following the earth's curves in plowing saves valuable agricultural land from being blown away by wind and washed away by water.

because it was Americans who did it, but because of their boundless resources and the fact that theirs was among the last of the great developments and they had the advantage of all the experiences and discoveries and inventions that had gone before.

No other people had so much wealth of resources to waste. When America was first colonized, the soil was new. Nature had been millions of years in making and enriching it. Cropping this soil heavily and without manure or rotation was the natural course. For all the farmer knew, this new soil would last forever, and if it should wear out there was plenty more quite as good just outside the settlement. So why should he conserve? Necessity taught him to waste. His was a life of destruction—not of protection. But we have come to the end of wasting. We have reached a point where we have to save or suffer.

The first real step in organized conservation in the United States was the establishment of the Bureau of Foresty in 1891. So important had conservation become by 1908 that Theodore Roosevelt, then President of the United States, called at the White House the Conference of Governors to consider the best means of conserving from waste all the resources of the United States. This historic assembly marks the beginning of a definite conservation policy in the United States, and was shortly followed by the appointment of a National Conservation Commission to study the needs of the country.

Since that time, many millions of acres of government-owned lands have been withdrawn from public sale. Tracts of valuable timber, rich areas of coal, phosphate, and other minerals, and great sites for the development of irrigation, flood control, and electric power are included in these lands. The government sometimes disposes of its land by sale or lease, but retains the right to direct the development and conservation of leased property, in order to safeguard the interests of the public. Many public and private organizations have been formed to support various phases of the conservation movement.

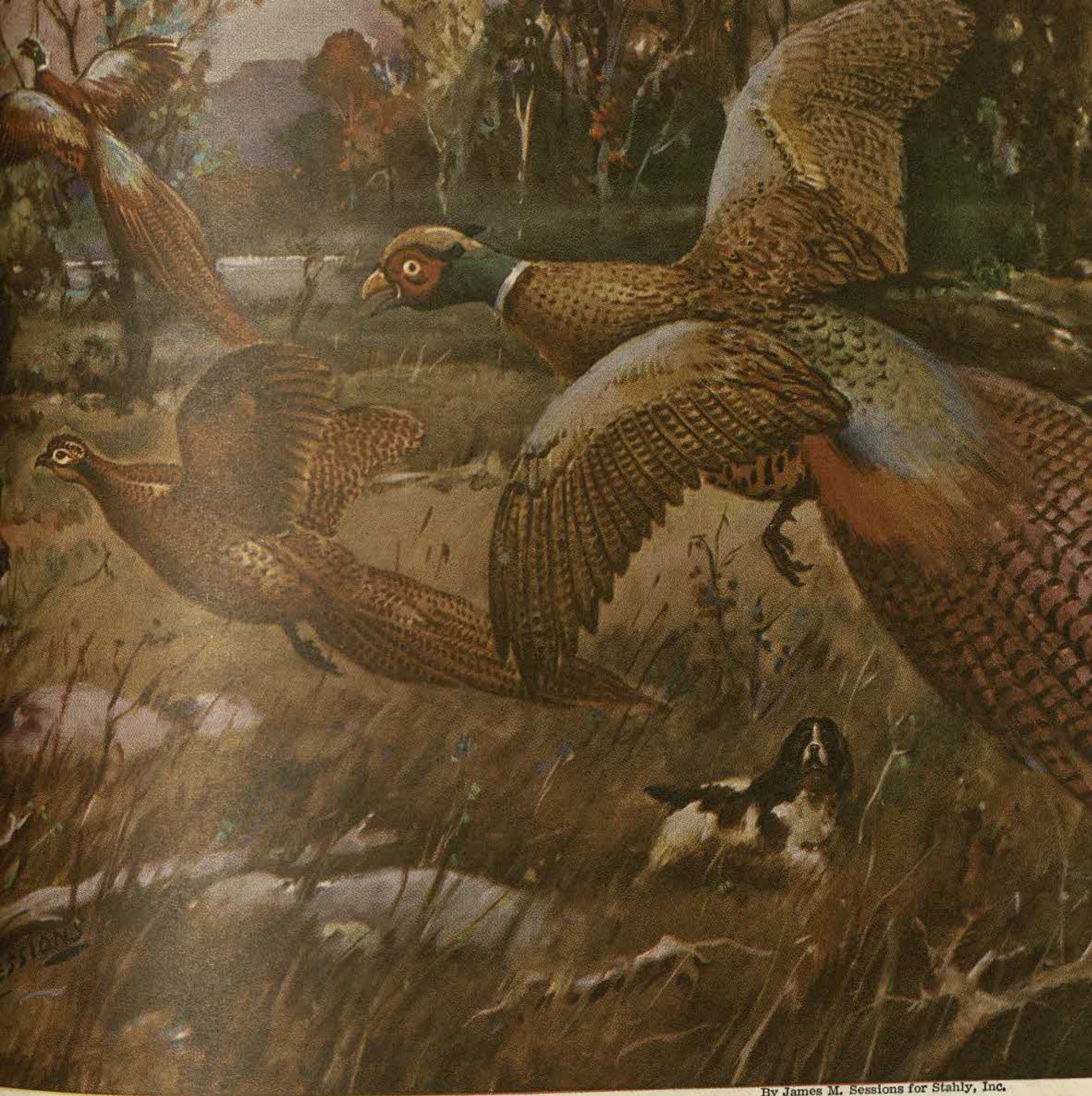
How Land Is Conserved. Soil can be conserved and made more productive by use of fertilizers, by crop rotation, and by the

"BANDIT AT FIVE O'CLOCK HIGH!"

This warning means "Enemy aircraft approaching." In hoary marmot language it is just a loud squeak, but it means the same. Hoary marmots live in the Rocky Mountains. When they come out of their burrows to hunt food or to sunbathe, they appoint sentries to watch for eagles. This is part of nature's own conservation program, because hoary marmot is a favorite food of eagles and their young.

THANK THE HUMMINGBIRD

This beautiful little bird makes it a habit to stick its bill into other creatures' business. It can hover motionless over a flower while its beak probes deep into the blossom, seeking insects which have hidden there to sip nectar. Insects make up more than half the diet of a hummingbird. We protect and encourage the hummingbird because it eats harmful insects that destroy crops.



By James M. Sessions for Stahly, Inc.

CONSERVATION OF GAME BIRDS

Sportsmen find good hunting in many regions because state conservation authorities restock fields and woods with game birds. Here, ring-necked pheasants—two cocks and a hen — fly up before the hunter's dog. Ring-necked pheasants are relatives of the guinea fowl (top left), the peacock (left), the golden pheasant (below), and the domestic hen and rooster (right).

Weyerhaeuser Timber Co.

FOUNDER OF FUTURE FORESTS

The seedling pine that this forest ranger is planting eventually will be part of a great forest. The aim of the reforestation program is to replant a tree for every one cut down.

control of land erosion. Terracing hillsides, planting trees and grass to hold the water that would otherwise wash away the earth, and filling gullies with brush are intelligent methods of saving agricultural land from the destructive effects of erosion. Flood control, too, is of vital importance. Along the banks of large rivers, levees have been built to prevent disastrous flooding of productive farm lands during the spring, when river waters are swollen by heavy rains.

The disastrous dust storms that ruined many acres of productive land in the Great Plains were an aftermath of prodigal farming. The area is subject to periodical droughts, but was developed during a cycle of rather humid years. Over-cultivation of the land exhausted the subsoil moisture and made the topsoil so loose that it was easily carried away when high winds blew over the Great Plains in the critical drought years. The restoration of the lands devastated during this tragedy of the 1930's was a major undertaking of the conservationists of the United States government.

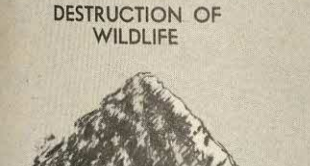
How Minerals Are Saved. Unlike forests or land, once minerals have been mined they can never be replaced. It is therefore of great importance that they be used sparingly. In 1937, the United States Army and

WASTE OF NATURAL RESOURCES

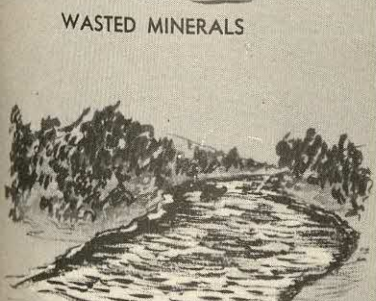
BARREN TIMBERLAND

ERODED FARMLAND

DESTRUCTION OF WILDLIFE



WASTED MINERALS



WATER WASTE

METHODS OF CONSERVATION

Lumbering planned so that "seed trees" remain uncut.

Fire prevention

Forestlands reserved as national parks.

Contour plowing

Trees planted as windbreaks.

Gullied slopes reforested.

Game refuges

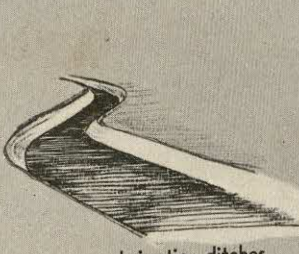
Game treaties with neighboring countries.

Hunting of wildlife restricted to certain seasons.

New ways of using minerals are investigated.

Better working methods to prevent unnecessary waste.

Better transportation.



Irrigation ditches to bring water to farms.

Dams to use water power.

Navy Munitions Board listed strategic and critical mineral materials in such short supply as to cause concern. When the demands of World War II made serious inroads on this diminishing supply, the government adopted a program of *stockpiling,* or acquiring stocks of essential minerals from other countries for future need. Stockpiling became a permanent policy of the government by act of Congress in 1946.

There are many other measures that can be adopted to add to the available supply of minerals. Coal miners used to leave a third of the vein in the ground as supports. Now, as mines are "worked out," these supports are being mined and used. The use of water power for generating electricity formerly produced by coal is another means of saving this fuel. This the government is promoting by building more and more enormous dams at strategic points throughout the country. These produce electric power, provide irrigation water, and help to prevent floods. Although enormous amounts of oil are still wasted, drilling, refining, and distributing methods are improving.

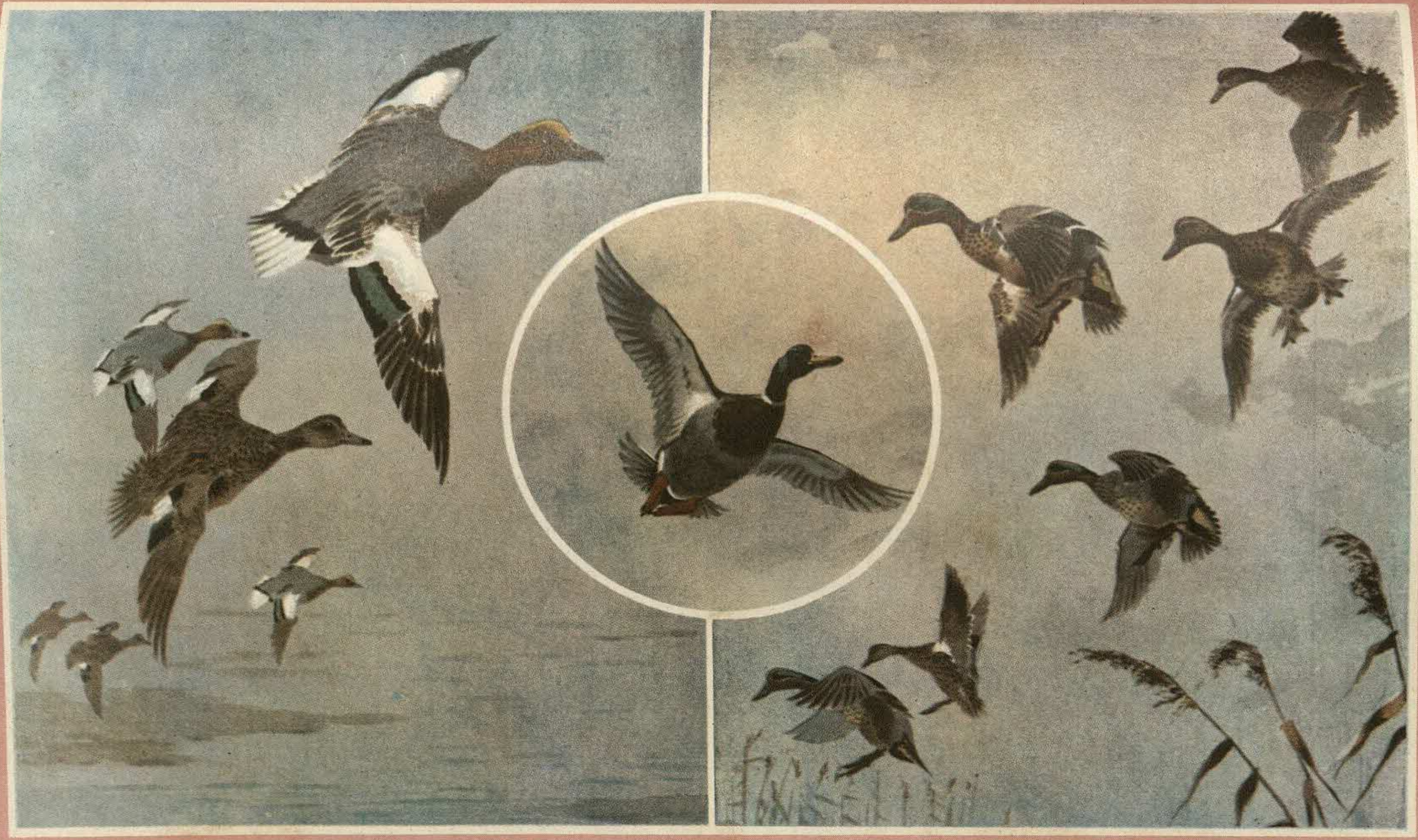
What About the Forests? Trees once cut are gone beyond recall, but the land may be replanted. Too long have we depended on Nature to do our reforesting. During the Franklin D. Roosevelt administrations, an extensive program of reforestation was undertaken by the Civilian Conservation Corps, in an effort to check the rapid depletion of the nation's forests. In addition to this work, members of the Corps constructed river levees at danger spots, and engaged in projects to prevent soil erosion.

When America was first settled, vast areas of virgin land were clothed with the primeval forests, and the colonists had to destroy these forests to make room for wheat and corn, gardens and orchards. As the country expanded and new industries followed the westward-moving frontier, large areas of forest land came under private ownership. There was little thought of saving the trees.

Union Pacific Railway

HELPING DEER SURVIVE

Rangers put out hay for hungry herds of deer during bad winters in the western United States.



AT HOME ON LAND AND WATER—AMERICA'S FAST-FLYING TOURISTS, THE WILD DUCKS

There's a thrill, spring and autumn, in seeing these beautiful waterfowl race across the sky, at nearly ninety miles an hour. At the left, widgeons, with the colorful male in the lead. In the circle is a wise old flight commander, a mallard drake. Right, a mixed flock of teal just "getting up."

The chief idea was to get the timber out, regardless of waste. Now, thanks to the Forest Service, this policy has been changed. The forests are being protected and restored instead of being exploited and wasted, and the Forest Ranger Service is ceaselessly fighting the fires that have destroyed so many thousands of acreas of valuable timber.

Timber is also being conserved by means of chemistry. New methods are constantly being found for utilizing the waste products of the lumber industry. The treatment of wood to make it fireproof, new pulping and bleaching processes, and the manufacture of plastics from wood cellulose are among recent developments in this field. Wood is now our greatest source of cellulose.

Conserving Our Wild Life. Not all wild life is protected by game laws. Among the animals that are distinct liabilities are bears, mountain lions, bobcats, lynxes, wolves, coyotes, and rats. There is a continual open hunting season on all these, for they cost the United States millions of dollars annually in human lives, livestock, and crops. Jack rabbits, prairie dogs, and ground squirrels are poisoned by the thousands.

On the other hand, valuable fur-bearing animals, including the fox, mink, otter, seal, and raccoon, are actually increasing under the government's protection. Fish are not only protected by law, but hatcheries are maintained for the replenishing of lakes and streams with small fish. The habits of migratory birds, such as wild ducks and geese, have been studied by government experts, and feeding grounds have been established to promote multiplication of this bird life. National parks, wherein deer and buffalo range unmolested, have been one of the greatest means of increasing these animals.

Use of Water Resources. America has a vast amount of potential power in its rivers. Years ago, New England, particularly Massachusetts and Connecticut, took advantage of this fact and became the "beehive" of America, building factories along these rapid streams and taking full advantage of the abundance of cheap labor and power.

But it is only recently that our bigger sources of power have been developed. Many large projects, including the Tennessee Valley, Coulee Dam, and Hoover Dam projects, have been built by the Federal government not only to provide many cheap sources of hydroelectric power, but to supply the surrounding countryside with a vast volume of water for irrigation. Irrigation dams have been responsible for the reclamation of thousands of acres of barren desert, converting them into rich, green farm lands. As a result of hydroelectric power, known as "white coal," thousands of tons of coal are saved every year that were formerly used in producing electric power. And a higher standard of living has resulted, for many isolated farm homes are now being served with cheap electricity under the government's Rural Electrification Program.

For further information, consult the following articles:

Coal
Flood
Forests and Forestry
Irrigation

CONSERVATIVE, *koṅ sur'va tiv.* In general, the word *conservative* implies a tendency to resist change. It is applied to those people who are satisfied with things as they are and who are opposed to radical or hasty changes in the existing order.

In Great Britain and Canada the Conservative party is one of the major political parties. The members prefer the existing economic order and are interested only in slow and minor changes.

CONSER'VATORY. The word *conservatory* brings to mind two cultural institutions: a place where all branches of music are taught and a place where beautiful flowers, plants, and shrubs are housed.

The earliest conservatories were in Italy; there orphans were cared for and taught music and declamation. The first conservatory strictly a school of music was founded in Naples in 1537. The *Conservatoire de Musique* established in Paris in 1795 in connection with the opera ranks first among music schools of the world. The Conservatorium at Leipzig is one of the most noted in Germany. Among the best-known conservatories in the United States are the National Conservatory in New York, the New England Conservatory in Boston, and the Peabody Institute in Baltimore.

The other type of conservatory is a glass house where rare plants and many varieties of flowers are displayed (see BOTANIC GARDENS).

CONSONANT, *kon′so nant.* All the letters of any word are either consonants or vowels. In the sounding of a consonant, the breath is stopped by the tongue, lips, and teeth. Vowels are uttered easily through the mouth passage. Usually a consonant is sounded in connection with a vowel. *N* and *m* are classified as nasal consonants; *l* and *r* as liquids; *g, d,* and *b* as mediæ; *gh, dh,* and *bh* as aspirated mediæ; and *z, j,* and *v* as spirants. Some consonants have very little sound; when used with a vowel they merely determine the manner of pronouncing the beginning or ending of vowel sounds, as *af, fa, ad,* and *da.* Other sounds, like *i* and *u,* are semi-vowels because they serve both as consonants and vowels. See VOWEL.

CON′STABLE, JOHN (1776-1837). Much of England's lovely countryside was painted in all its natural beauty by John Constable, a famous artist of the latter eighteenth and early nineteenth centuries.

A native of Suffolk, Constable worked in his father's mill when a youth, leaving in 1795 to study art in London. Four years later he entered the Royal Academy and in 1802 exhibited his work for the first time. His subjects, done in oil and water colors, are scenes from Suffolk, Hampstead, Brighton, and Salisbury, some of the most famous paintings being *The White Horse, Salisbury Cathedral, The Cornfield,* and *The Hay Wain.* His use of fresh, vivid colors brought about a great change in landscape painting, and other artists have imitated his style. Constable's works may be seen at the Louvre, in Paris; the Metropolitan Museum and the Public Library, New York; and the Toledo Art Museum.

CONSTANTINE, *kon′stan tine,* CAIUS FLAVIUS VALERIUS CONSTANTINUS (about 287-337). A brave soldier and a very religious man, Constantine was the first Roman emperor to become a Christian. He was a powerful ruler and enacted laws badly needed by his people. In history he is known as Constantine the Great.

At the time of Constantine's birth, the Roman Empire was divided into two parts. His father, Constantius Chlorus, was ruler of the Western Empire, and, at his death in 306, the army proclaimed the son emperor. But Constantine found it necessary to overthrow a rival to maintain his authority in his realm.

According to an old story, Constantine had a dream just before the battle with his rival. In the sky, he saw a burning cross on which was written, "In this sign thou shalt conquer." He immediately made the cross his emblem and triumphed over his rival. Thenceforth, in Rome, Christians were permitted freedom of worship. Eventually, Constantine made Christianity the state religion and, shortly before his death, became a Christian himself.

In 324 Constantine was victorious in the East and became ruler of the whole Roman Empire. Six years later he moved his capital from Rome to Byzantium, which was named Constantinople in his honor. He ruled from the new capital until his death in 337.

Constantine not only paved the way for Christianity in Europe, but he connected it with the state, thus laying the foundation for the difficulties between Church and state in the years to come. His laws reflected the influence of religion. His military reforms provided for a strong defense against outsiders and for peace within the empire.

The Arch of Constantine is a famous monument which still stands in Rome. It was erected in 315 to commemorate the victory of Constantine over Maxentius, a Roman general.

GATEWAY TO THE ORIENT, THE NARROW BOSPORUS

Constantinople, the meeting place of East and West, has been a trade center for centuries. Here, picturesque peasants, such as the one at the right, vie with modern commerce.

CONSTANTINOPLE, *ḳon stan ti no′p′l,* officially ISTANBUL. Situated on a promontory on the narrow Bosporus, the colorful city of Constantinople held the commerce of the world for centuries. The largest city in Turkey, though no longer its capital, it straddles the Bosporus, where for more than 2,000 years it has dominated commerce between the Mediterranean and the Black Sea. Though most of the city lies in Europe, it is chiefly oriental in character.

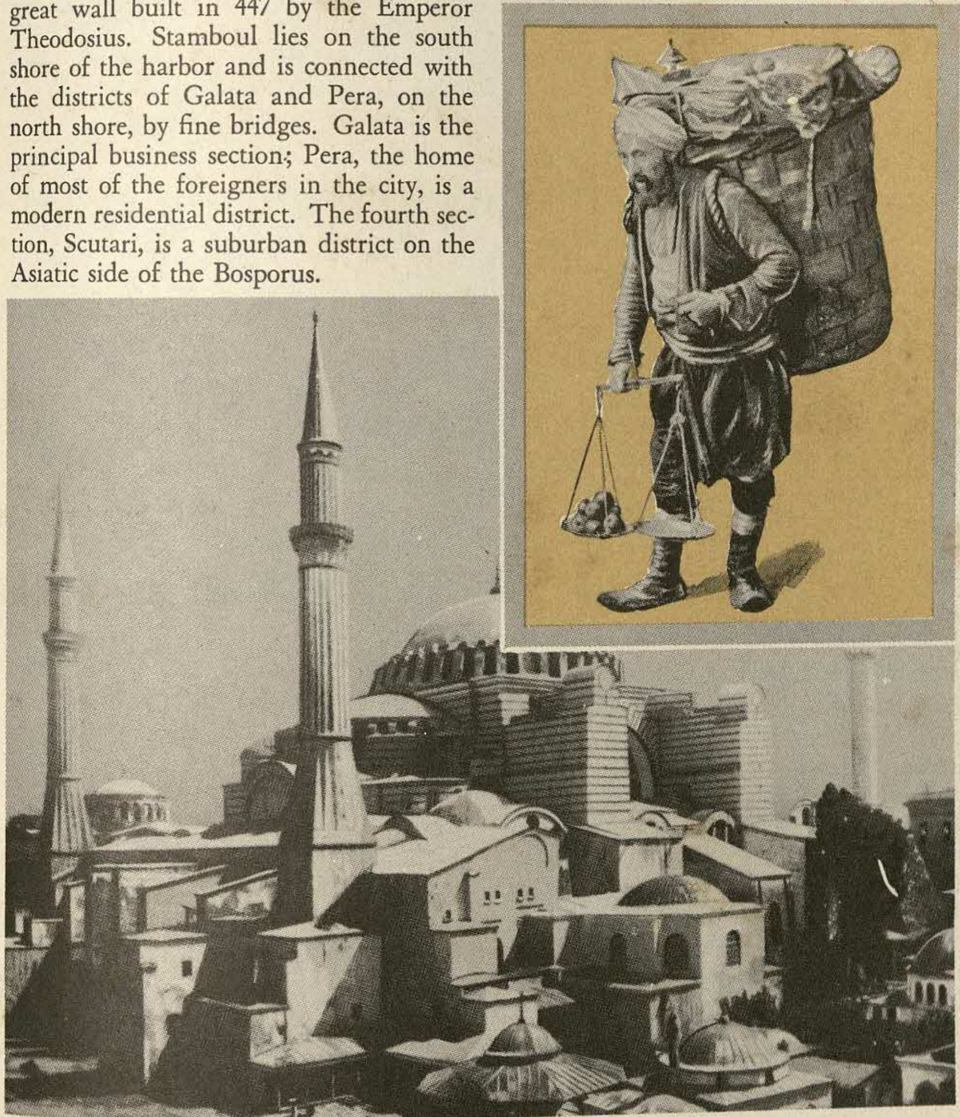
"Queen of Cities." Constantinople merited this name in the days of the Byzantine Empire, when it was the world center of culture and commerce. Learning thrived in the city even when the rest of Europe was benighted by the Dark Ages. But centuries of foreign invasions, civil wars, and earthquakes brought turmoil to the city. By the opening of the twentieth century Constantinople was a city of poverty and squalor.

With the revolution of 1908-1909, Constantinople suddenly sprang to new life, modern buildings replaced old wooden structures, motor cars and street cars were introduced, and a new granite-paved bridge was built from Galata to Stamboul. Pera's modern shops form a striking contrast to the Grand Bazaar, native trading place of old Stamboul. Of the many mosques that formerly dotted the city, scores have disappeared. But many are still standing, among them Saint Sophia, converted into a mosque in 1453 and renamed Mosque Mehmedie (Mosque of Mahomet) in 1923. The mosques of Suleiman, Sultana Valide, and Sultan Achmet are also of interest to tourists.

Other points of interest in Constantinople are: a group of government buildings, called the Sublime Porte; the Serpent Column, brought from Delhi, India, by Constantine; and the Museum of Antiquities in Seraglio Park. Many underground reservoirs, connected by modern aqueducts, supply the city's water.

Constantinople is built on the shores of a magnificent harbor, known as the Golden Horn. The city comprises four main sections. The most important of these is Stamboul, the Mohammedan center, which is built on the site of the original settlement. It is surrounded by water on three sides; the fourth side is protected by a great wall built in 447 by the Emperor Theodosius. Stamboul lies on the south shore of the harbor and is connected with the districts of Galata and Pera, on the north shore, by fine bridges. Galata is the principal business section; Pera, the home of most of the foreigners in the city, is a modern residential district. The fourth section, Scutari, is a suburban district on the Asiatic side of the Bosporus.

Education. Constantinople is the educational and cultural center of Turkey. The University of Istanbul has colleges of law, medicine, science, arts, and economics. Also at university level are the Institute of Education and the Technical University of Istanbul. Two colleges founded by Americans, Robert College and the American



SENTINELS OF AN ANCIENT CITY

Saint Sophia, for five centuries a Moslem mosque, stands guard over the city of Constantinople, a vivid reminder to the teeming population of the city's former glories. The apple merchant, shown above, sells his wares in the same manner as his ancestors did.

College for Girls, have been combined into a coeducational institution for young Turks. Among other educational institutions are the Academy of Fine Arts and the Economic and Commercial School. The city is notable also for its many museums. The former cathedral and mosque, St. Sophia, now Aya Sophia, is among these, and so is the former imperial palace.

Manufacturing and Transportation. Constantinople is famous for its handmade articles, such as carpets and embroideries. Chief among factory products are tobacco goods, fezzes, iron ware, leather articles, and perfume. Manufacturing and export and import trade are increasing, aided by fine transportation. The Golden Horn can accommodate as many as 1,000 large ocean liners at one time. Railways connect the city with Asia and Europe. Ferry and steamship service handle local transportation.

History. A hotbed of strife and warfare since its beginning, Constantinople was founded by the Greeks in the seventh century before Christ. According to mythology, the site was first reached by the Argonauts long before. Under Greek rule, however, the city was known as Byzantium. Darius II conquered the city in 513 B. C., but held it only a short time. In A. D. 330, the Roman emperor, Constantine the Great, realized the strong position of the city and established his capital there, changing the name to Constantinople.

At the time of the Crusades, the Christians captured the city twice, only to surrender it for all time to the Turks in 1453. The city became the capital of the Turkish Empire. Constantinople, which had been a center of Greek learning, was deserted by the Greek scholars, who fled into Christian Europe. Thus Constantinople was indirectly responsible for the revival of learning that swept over Europe.

From 1453 on, European nations vied with one another in an effort to gain control of the Bosporus. None was successful. The last determined effort was during the first World War in 1915. The result was another failure. In 1922 Turkey became a republic under Mustapha Kemal Pasha, the old line of caliphs was abolished, and the capital was transferred to Ankara. Since the close of World War I, when the city was briefly occupied by the Allies, the city has borne the name Istanbul.

The population of Constantinople is about 1,000,000. With the suburbs, the population is 1,180,000.

Consult the following titles for additional information:

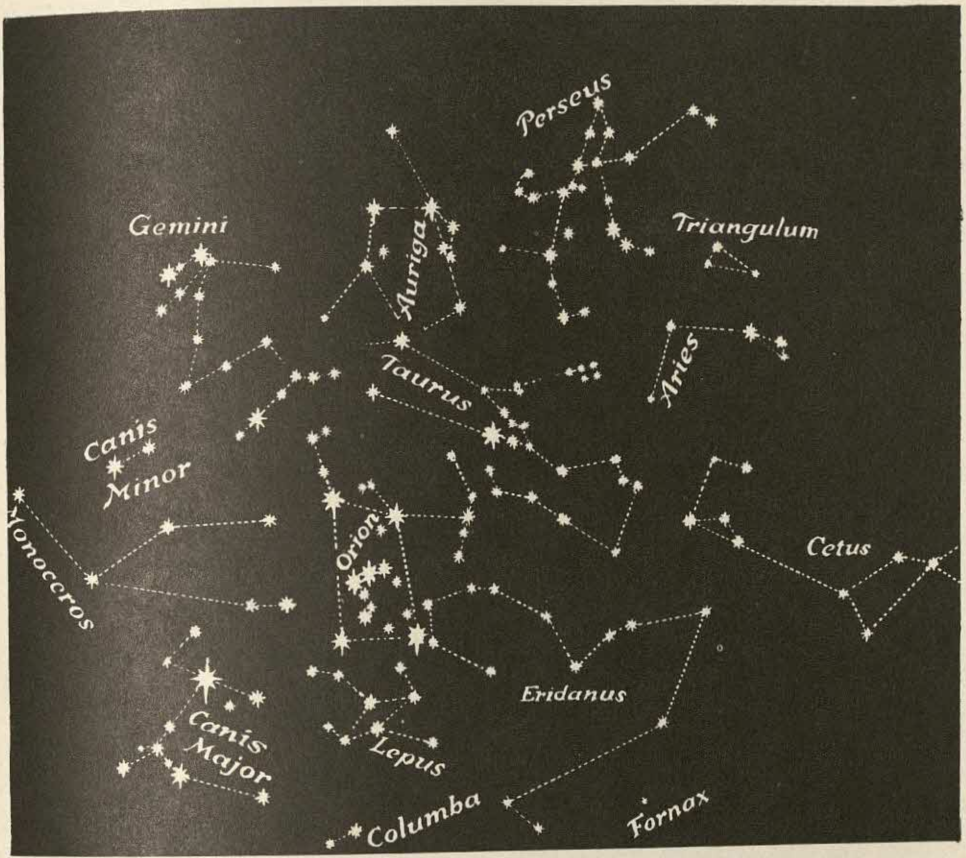
Byzantine Empire
Constantine
Dardanelles
Renaissance
Turkey

CONSTELLATIONS, *kon stel a'shunz.* These are star pictures in the sky, created by the imagination. On a clear night the great dome of the heavens seems a maze of countless stars. Some are close together, some far away from any others; some are bright and some but dimly visible. In ancient times, men who studied the heavens noticed certain groupings of the stars, and called them constellations. They gave these groups names of the objects they seemed to suggest—animals, mythical persons, and so on. Down through the ages the ancient names have been retained.

There are twelve star groups near the path that the sun seems to follow across the sky. We call them the signs of the zodiac, and they are named in a little rhyme composed by an English writer of hymns, Isaac Watts—

The Ram, the Bull, the Heavenly Twins,
And next the Crab, the Lion shines,
  The Virgin and the Scales,
The Scorpion, Archer, and He-Goat,
The Man that holds the watering pot,
  The Fish, with shining tails.

The Big Dipper, or Great Bear, a familiar spectacle in the northern sky, is another constellation known to the ancients. So, too, is Orion, the Hunter, a brilliant group of stars on the celestial equator. One of the smaller constellations is Cassiopeia, or "Lady in her Chair." People living in the Southern Hemisphere see constellations never visible to our eyes, such as the Southern Cross. The constellations appear in different parts of the sky as the seasons



MEN AND BEASTS AMONG THE STARS

By drawing imaginary lines between the stars, men have formed figures which represent such things as a bull (Taurus); a "champion" (Perseus); twins (Gemini), so-called because of the two bright stars; a hare (Lepus); and a hunter (Orion).

change. It is an interesting exercise to study the night sky with a star map and to locate the constellations month by month.

Consult the following titles for additional information:

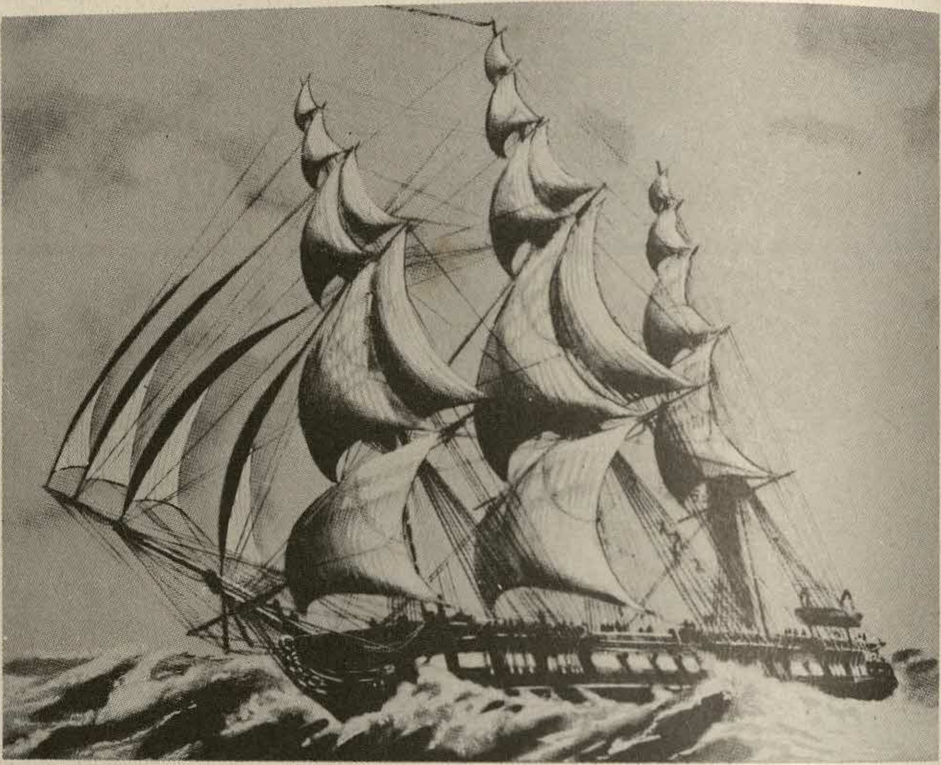
Astronomy
Bear, Great
Cassiopeia
Gemini
Milky Way
Orion
Pleiades
Southern Cross
Stars
Taur
Virgo
Zodiac

CONSTITUTION, The. Dear to every American is the name *Old Ironsides*. It is the nickname of the frigate *Constitution*, which won many victories and never met defeat.

The vessel was launched October 21, 1797, one of the first three ships built by the United States. From 1803 to 1805, the *Constitution* headed the American fleet in the war against Tripoli, a territory in Northern Africa which served as the headquarters of the Barbary pirates.

During the War of 1812, the *Constitution* achieved immortal fame by defeating one after another of the British frigates. In the battle with the *Guerrière*, the cannon balls of the enemy seemed to bounce off the wooden sides of the American ship. It was then that she was first called *Old Ironsides*. In less than a half hour, the *Guerrière* became a total wreck. At another time, under the command of Captain Isaac Hull, the ship outraced an entire British squadron.

The United States government ordered



THE CONSTITUTION, AMERICA'S MOST FAMOUS FIGHTING SHIP
Affectionately called "Old Ironsides" by the crew, because of her fighting ability, the *Constitution* fought against the Tripolitan pirates and played a prominent part in the War of 1812 with Great Britain. Rebuilt three times, the ship is preserved today as an historical relic.

the *Constitution* destroyed in 1828, since the ship was no longer seaworthy. But the public, aroused by Oliver Wendell Holmes's appealing poem, *Old Ironsides*, protested and saved the ship. The boat was rebuilt in 1833 and again in 1877.

In 1931 the school children of America contributed enough money to have the ship restored to its original design. The *Constitution* was then exhibited in various coast cities of the United States.

CONSTITUTION OF THE UNITED STATES. "We the people of the United States, in order to form a more perfect union," are the first phrases of the preamble to the Constitution of the United States. The significance of these words is the fact that the colonists, after more than a hundred years, had attained freedom, individual liberty, and a voice in their own government. The Constitution was the fulfillment of the hopes and dreams of the Pilgrims and all who came after them.

The Constitution has a two-fold background. First, it is based on the philosophy of John Locke, an Englishman, who believed that freedom of action and thought is a natural right of man. Second, the framers of the Constitution benefited from the experiences of the colonial governments from the time of the Pilgrims up to the Declaration of Independence. The colonists, under the rule of charters granted by the king in England and administered by his officers, came to have a measure of representative government, in that they were represented in the lower house of the legislature in each of the original colonies.

LAYING THE FOUNDATION FOR AMERICA'S GOVERNMENT

In order to bind the states together after the Revolution, leaders of the day, including Washington and Franklin, met in a Constitutional Convention in Philadelphia in 1787. The result was our present Constitution, so thoroughly practical that it is still our basic law.

The Articles of Confederation. After the colonies declared their independence, they drew up their own constitutions and became states. These state constitutions followed colonial models. Although they gave the colonists the right to govern themselves, they were not democratic in spirit, as only property owners and taxpayers were allowed to vote and to hold public office. The individual states, however, were not large enough or strong enough to protect themselves. It was for the purpose of binding them together in a union that the Continental Congress drew up the Articles of Confederation, in 1777; they became law in 1781.

The Articles represented the states, not the people. The men who wrote them, weary of strong government by the British king and Parliament, purposely created a weak government. Congress was a loose-jointed affair, a sort of committee for the states. Each state had one vote, a small state sharing equal power with a large one. Because there was no executive officer to see that the laws of Congress were carried out, the states did just as they pleased about them. Congress had no coercive power to force the states to do its bidding. For example, it could vote money for public use, but could only ask the states to raise it, and very often the states did not raise the money. Congress could not regulate trade, enforce commercial treaties, or compel the states to stop issuing money in competition with that of the central government.

The result was that the United States lost its financial credit and could not pay its bills. The cheap paper money issued by the states caused inflation, and money was worth only a few cents on the dollar. Tariff barriers were raised between states, and trade languished.

It was necessary to do something to change a situation which threatened the very existence of the nation. Consequently, Virginia asked the states to send delegates to a conference at Annapolis to discuss taxation and commerce. Delegates from only five states appeared, but Alexander Hamilton succeeded in having them pass a resolution urging Congress to call another convention in Philadelphia.

Making the Constitution. When that convention first met in May, 1787, some of the most eminent men in the country were present, among them George Washington, James Madison, Alexander Hamilton, and Benjamin Franklin. Many problems confronted these men. Should they merely revise the Articles or plan a new government? In a new government who would be given the right to vote? Should the people elect the President and members of Congress? The greatest conflict arose between the New Jersey plan, which called only for a revision of the Articles, and the Virginia plan, which advocated a new constitution. The answer to the question as to whether it should be a government of the states or of the people was settled by compromise. Both should have a share in the government. Who should vote? The individual states were to decide.

With these fundamental questions settled, the convention then went to work to set up the details of the new government. The members decided to have a two-house legislature in order to settle the differences between large and small states; all states were to have equal representation in the Senate and were to have representation in the House of Representatives according to population. The people were to elect the Representatives, and the states the Senators. The executive department was to consist of one man, the President, who should be elected by the people through electors, for a term of four years.

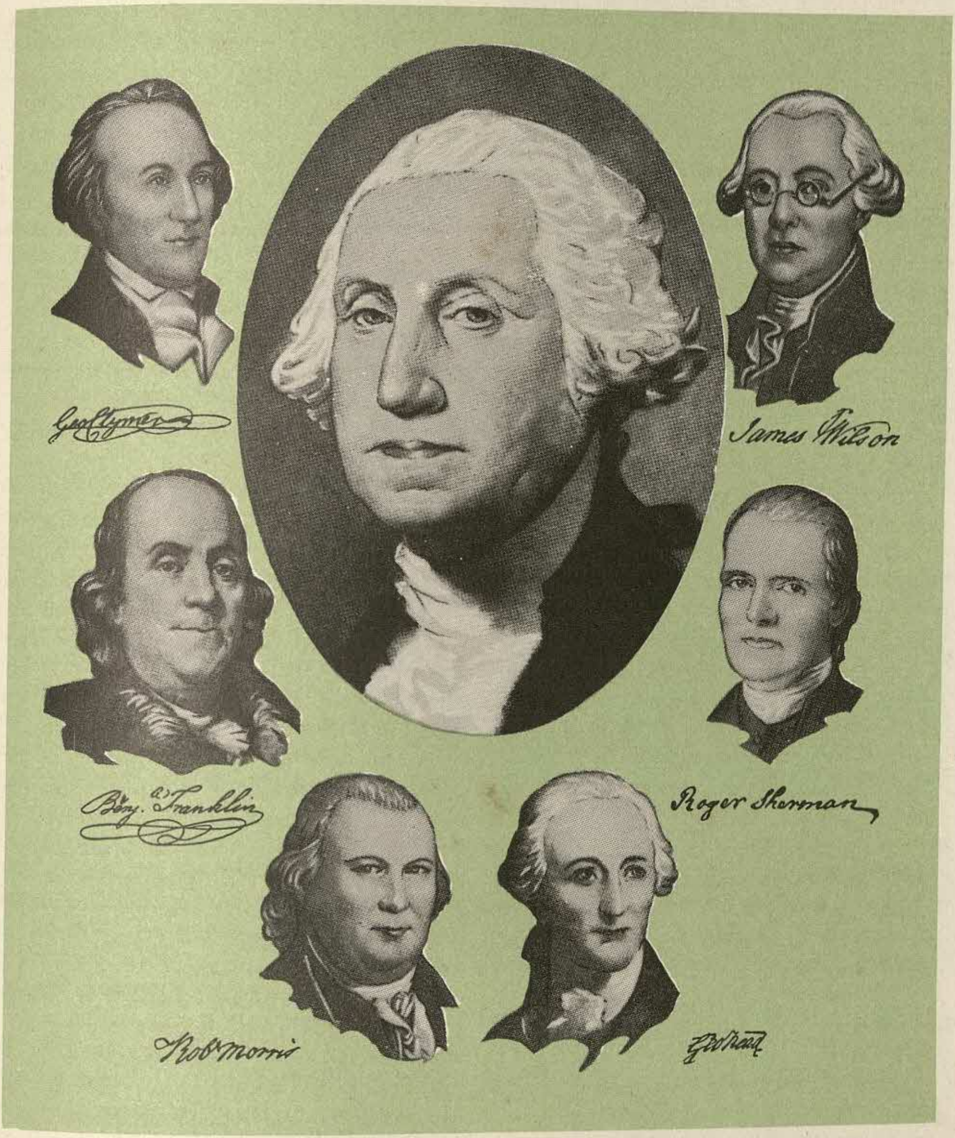
The framers of the Constitution knew that a system of courts would be necessary to enforce the laws created by the Congress. So a Supreme Court was set up to review cases which had been tried in the lower courts. Thus the power of the government was divided among three branches—the executive, judicial, and legislative.

A System of Checks and Balances. In order that the power of the three branches should always remain equal, the framers set up a system of checks and balances. The Senate could check the powers of the President by its right to ratify appointments and treaties. The House and Senate could check each other in the passing of bills. The President could veto the acts of the Congress, which could pass a bill over his veto by two-thirds' vote. The judicial power was extended to all cases arising under the Constitution. (Under Chief Justice Marshall, the custom was established of having the Supreme Court rule on the constitutionality of laws passed by Congress.) In this fashion, all branches were balanced in power and could check one another.

To keep the states from becoming too powerful, the Constitution reserved certain powers to the Federal government, such as the coining of money, the right to make treaties, the power to declare war, and many others. The framers realized that their work could not possibly cover all the situations which might arise in later years; so they wisely provided ways in which the Constitution could be amended. Shortly after it had been adopted by the states, the first ten amendments, called the Bill of Rights, were added, guaranteeing certain inherent rights of man, such as freedom of the press, speech, and worship, and trial by jury.

Putting the Constitution to Work. After the Constitution was completed, many of those at the convention were not satisfied with it. Some were of the opinion that it had no value; others thought that it was not very good but that it was the best that could be written. It was submitted to the states in 1787, however, for their approval. By the end of that year, three states had adopted it, and during the next year and a half all the others had signified their approval, although some ratified it by the narrowest of margins.

Before it was approved, however, the Constitution was hotly discussed by the people. While some supported it, others criticized it, declaring that the rights of the



WASHINGTON AND SIX SIGNERS OF BOTH THE DECLARATION OF INDEPENDENCE AND THE CONSTITUTION

General Washington presided at the convention where these prominent signers of the Declaration of Independence were privileged to place their names also upon the Constitution. They are, left to right, top; George Clymer, Philadelphia banker, and James Wilson of Pennsylvania; center, Benjamin Franklin, the "Sage," and Roger Sherman of Connecticut. Bottom, Robert Morris, "Financier of the Revolution," and George Read, who made Delaware the first to ratify.

people were being trampled on and that the President would become a dictator. The *Federalist* papers, written by Madison, Hamilton, and Jay, are valuable for their defense of the Constitution by these framers of the document. See FEDERALISTS.

The Constitution came into operation in 1789. The first ten amendments were adopted in 1791. Since 1791, there have been only twelve amendments added in the course of the history of the United States. It is believed by many scholars that the reason so few amendments have had to be added is that the framers kept the Constitution simple and laid down only the basic framework of government. The Supreme Court has the power to interpret the meaning of the Constitution for situations not definitely provided for in the Constitution. If the Constitution had laid down more detailed rules covering many situations, many more amendments probably would have had to have been added as conditions changed. As it stands, the Constitution seems to have proved its worth as a document well-suited to govern men in times of crisis, war, and peace. The Constitution has been studied and admired by men all over the world and many of its provisions have been copied. William E. Gladstone, Prime Minister of Great Britain, once said that "—the American Constitution is, so far as I can see, the most wonderful work ever struck off at a given time by the brain and purpose of man."

OUTLINE OF THE CONSTITUTION OF THE UNITED STATES

Preamble

Article I. Legislative Branch
- Section 1. Legislative powers
- Section 2. The House of Representatives
- Section 3. The Senate
- Section 4. Elections to Congress
- Section 5. Membership and Rules of Congress
- Section 6. Compensation and Privileges of Members
- Section 7. Ways of Passing a Bill
- Section 8. The Powers of Congress
- Section 9. The Powers Denied to Congress
- Section 10. Restriction of Powers of the States

Article II. Executive Branch
- Section 1. Election of the President and Vice-President
- Section 2. The Powers of the President
- Section 3. The Duties of the President
- Section 4. Impeachment

Article III. Judicial Branch
- Section 1. The Courts of the United States
- Section 2. Jurisdiction of the Courts
- Section 3. Definition of Treason

Article IV. Relation of the States to the Federal Government
- Section 1. State Records
- Section 2. The Privileges of Citizens
- Section 3. Admission of New States
- Section 4. Republican Form of Government

Article V. Amendment of the Constitution
Article VI. Oath to the Constitution
Article VII. Ratification of the Constitution

Amendments to the Constitution. The greatest obstacle to the prompt ratification of the Constitution by the states was the fact that the document contained no statement concerning the inalienable rights of man. The states adopted it only on the condition that the first Congress draw up several amendments that specifically granted these privileges. Accordingly, the first ten amendments, called the Bill of Rights, were adopted in 1791. The Eleventh and Twelfth Amendments were ratified in 1798 and 1804, further adding to the provisions of the original document. The Thirteenth, Fourteenth, and Fifteenth Amendments, adopted in the years following the close of the Civil War, were designed to protect the rights of the Negroes. The Sixteenth and Seventeenth Amendments were adopted in 1913, the Eighteenth in 1919, the Nineteenth in 1920, and the Twentieth and Twenty-first in 1933. The Twenty-second became effective in 1951. An outline of the amendments follows:

Article I. Guarantees freedom of religion, of speech, of the press, and of assembly.

Article II. Guarantees the right of citizens to bear arms.

Article III. Guarantees that soldiers will not be quartered in private houses without consent of the owners.

Article IV. Protects citizens against unreasonable search and seizure.

Article V. Provides that no one shall be held to answer for a crime unless indicted by a grand jury, be tried twice for the same crime, be compelled to bear witness against himself, be deprived of his rights without due process of law, or have his property taken from him for public use without just compensation.

Article VI. Provides for speedy trial by jury in criminal cases.

Article VII. Provides for trial by jury in civil suits in which the value at stake amounts to more than twenty dollars.

Article VIII. Protects citizens from cruel punishment and excessive fines.

Article IX. States that the listing of certain rights in the Constitution does not deny other rights kept by the people.

Article X. Provides that powers not given to the Federal government by the Constitution, nor prohibited by it to the states, are reserved to the states or to the people.

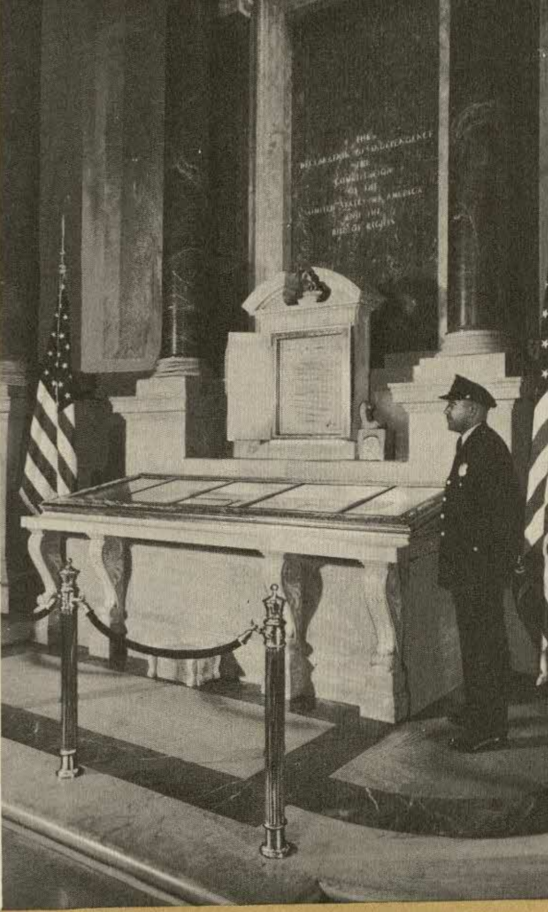
Article XI. States that the judicial power of the United States does not apply in suits against any of the states by citizens of another state or of any foreign state.

Article XII. Clarifies the provision in the Constitution for the election of the President and the Vice-President.

Article XIII. Abolishes slavery and involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted in a proper court.

Article XIV. Provides that all persons born or naturalized in the United States are citizens, cannot be deprived of their privileges and immunities without "due process of law," and are entitled to the equal protection of the laws; that Representatives shall be apportioned among the states according to population; that no one may hold Federal or state office who has rebelled against the United States or aided the enemy; and that neither the United States nor any state shall assume the obligations incurred in rebellion against the United States.

Article XV. Provides that citizenship shall not be denied because of race, color, or previous condition of servitude.



General Services Administration

A SHRINE OF DEMOCRACY

The Constitution, the Declaration of Independence, and the Bill of Rights, sealed in helium-filled glass cases, are on display in the National Archives in Washington, D. C.

Article XVI. Enables Congress to lay and collect taxes on incomes.

Article XVII. Provides for the direct election of Senators; and for the filling of any vacancies which may occur.

Article XVIII. Prohibits the manufacture, sale, or transportation of intoxicants.

Article XIX. Provides for woman suffrage.

Article XX. Provides that the terms of the President and the Vice-President shall end at noon on January 20 and of Senators and Representatives at noon on January 3 of the years in which their terms expire; that Congress shall meet at least once every year; that the Vice-President-elect shall become President in case of the death of the President-elect.

Article XXI. Repeals the Eighteenth Amendment.

Article XXII. Provides that a President cannot serve more than two terms, or if succeeding another President in mid-term, and serving more than two years, he can serve only one further term.

CON'SUL. See AMBASSADOR; DIPLOMACY.

CONSUMPTION, *kun sump' shun.* When you eat a slice of bread, burn a stick of wood, or wear out a suit of clothes, you are practicing consumption. There is a distinction between consumption and destruction of goods and resources. If men cut down a forest for lumber, that is consumption because it serves a useful purpose. The burning down of the same forest in a forest fire is destruction because no human need is satisfied.

Two Classes of Consumption. Consumption may be either *final* or *productive*. Eating a slice of bread is final consumption. But before you can eat it, the miller must use up the wheat to make the flour, and the baker must use up the flour to make the bread. These processes are not final consumption, for the wheat is consumed only that something may be added to it or a new product made. The above is an example of productive consumption, because something is produced as another product is consumed. There can be but one final consumption of a product, but there can be a great many productive steps in making the product.

Consumption and Prices. It is the consumer who determines the daily price of an article. When you and many others cease to use an article, the price goes down. When there is a brisk demand for the same product, the price rises. Taxes, too, have an important part in the price of an article, for the consumer pays taxes in the form of higher prices, charged by the manufacturer in order to conserve his profits.

Supply and demand usually combine to affect prices on commodities. If, because of a shortage of a desired product, prices rise, the higher prices will prevail as long as the demand for the product is maintained. If the buying power of the public is reduced to a point where the product in question cannot be bought in quantity, the price will fall. Again, an over-production of a product, with supply in excess of demand, usually causes prices to fall. Arbitrary curtailment of production to create an artificial scarcity is one method of keeping prices at a desired level. See SUPPLY AND DEMAND; ECONOMICS.

CON'TINENT. Imagine the earth with all the water drained from its surface. It would then be an enormous sphere with extensive depressions alternating with vast expanses of elevated land. While the surface of neither is smooth, the general level of the depressions is so much lower that normally they are submerged by the waters of the earth, and the large continuous masses rise above the water as continents, with their smaller irregularities of mountains, valleys, plains, and plateaus.

These ocean basins are more than full of water, so that the margins of the continents are under the sea. The submerged portion of the continents is called the continental shelf, and islands, such as the British Isles, on this shelf are continental islands. In some places, for example on the eastern coast of the United States, the continental shelf is very wide, more than 100 miles, in fact. At the outer edge of the shelf is a steep slope, the continental slope, which marks the real edge of the continent. On physical maps of continents, the continental shelf in each case is usually shown by a light-blue shading.

The habitable continents of the earth in order of size from largest to smallest are Asia, Africa, North America, South America, Europe, and Australia, the latter being called the island continent. There is also an Antarctic continent, probably between Europe and South America in size.

The adaptability of the different continents as the home of man varies greatly. Those consisting mostly of plains, like Europe, have a tremendous advantage in their favorable conditions for agriculture

THE ART OF LIVING

Once man used (or consumed) things just as they were found in nature. The consuming of natural products, in order to make new products for use, is an art that has developed through the years. Manufacturing and the sowing of grain are forms of *productive* consumption. When man eats his meals, *final* consumption takes place.

and for transportation both by land and river. The continents lying mainly in the temperate zone are much better adapted for white people than are Africa or South America, which have such large proportions in the tropics, or have, like Africa and Australia, a large part of their areas in the form of trade-wind deserts.

Lastly, some of the continents have much more irregular coasts, favoring commerce and modifying the climate over the land. Europe and Africa are almost the antithesis of each other in this respect. The latter, with an area three times that of Europe, has a coast line shorter by 4,000 miles. Europe, the most-favored continent in this respect, has an average population density more than twelve times that of Africa. Because no ocean separates them, Europe and Asia are sometimes called a single continent, Eurasia. Each continent is described in this work under its own title.

CONTINENT'AL SYSTEM. During the Napoleonic Wars between England and France early in the nineteenth century, Napoleon attempted to blockade England and ruin her commercially. This plan, known as the Continental System, led directly to the War of 1812 between England and America.

Napoleon believed that if his plan succeeded, he would not only paralyze England's industry but would ruin her credit, cause a food shortage, and deprive her of precious metals. The plan began with the Berlin Decree of 1806, followed by similar agreements at Warsaw, Milan, and Fontainebleau. By these agreements, trade in English goods was prohibited, European ports were guarded to prevent the entrance of English ships, all English property was considered fair prize, and Englishmen in territory held by France were taken prisoner.

England retaliated by announcing, in its Orders in Council, that all French and allied ports were likewise under blockade and prohibited any ships other than those of England from entering French ports. This amounted to saying that France and her allies could trade only with England.

France meanwhile announced that any ship that had been searched or had paid duty to Britain was to be denationalized and seized. All British goods seized were to be burned.

England, the mistress of the seas, was never in very grave danger from the blockade. Her ships virtually chased the French navy from the ocean, and the Continental System collapsed. In the meantime, French allies began buying British goods again. A temporary permit by Napoleon allowed the allies to buy American goods upon a payment of revenue. Americans began smuggling goods into France, whereupon several American ships were stopped by the English and goods and sailors were seized.

Russia, an ally of France, was one of the first to break the decree. France promptly invaded Russia, and it was this invasion that led to the downfall of Napoleon in 1814.

In the meantime, America and England had launched the War of 1812 because of England's searching of American ships. The result of the War of 1812 was that America's freedom on the high seas was definitely established. See War of 1812.

CON'TRABAND OF WAR. Those things which enable a belligerent (a nation at war) to continue fighting are contraband of war. Insomuch as a warring country cannot produce goods and at the same time have its men at the front, contraband articles are usually supplied by neutral nations which have goods to sell to anyone who will buy them.

International law recognizes the right of a nation to seize contraband goods which is being shipped to the enemy. There are definite rules which a warring nation is supposed to observe in the capture of suspected neutral ships. Violations of the rules by either side often involve a neutral country in war.

There are two classifications of contraband of war. *Absolute* contraband includes such things as munitions and arms; it is always subject to seizure. *Conditional* contraband includes merchandise intended for non-combatants, such as foodstuffs and clothing.

Following a declaration of war, the belligerents issue lists of goods to be considered contraband. Neutral nations then know that they deal in such merchandise at their own risk. Goods seized as contraband may or may not be paid for, depending upon the judgment of the nation seizing the goods. Neutral nations themselves cannot engage in contraband traffic, but most of them place no restrictions on the traffic by private citizens. See BLOCKADE; NEUTRALITY.

CON'TRACT. In law, an agreement or promise between two or more persons is called a contract. It consists of an *offer* by one party and an *acceptance* by another for doing or not doing some act or work.

In modern life, contracts are very important. They not only make possible a large number of services, but make fairly certain the obtaining of them, even if it becomes necessary to resort to the courts. Dealers buy goods under contract from wholesalers. Credit purchases by customers from dealers are made by contracts. Buildings are erected by contractors, whose very name implies that they contract to do work in exchange for pay. Money is borrowed under contract, and the interest paid is the consideration given for the use of the money.

In government, also, the theory of contract plays a part. Political thinkers have interpreted various forms of government as a result of contract.

Locke believed that a monarchy was the outcome of a theoretical contract between the king and his people. Rousseau wrote that the state came into existence as a contract among individuals. The President of the United States takes an oath to perform his duties and to uphold the Constitution, and in exchange he receives his high office and a salary.

Even in family life, contracts play a part. Marriage is a contract in which both parties agree to love and honor each other. Sometimes money or property is involved in a marriage contract. Gifts between friends or relatives may come under contracts because the feelings of affection and love are considered in law to be sufficient return.

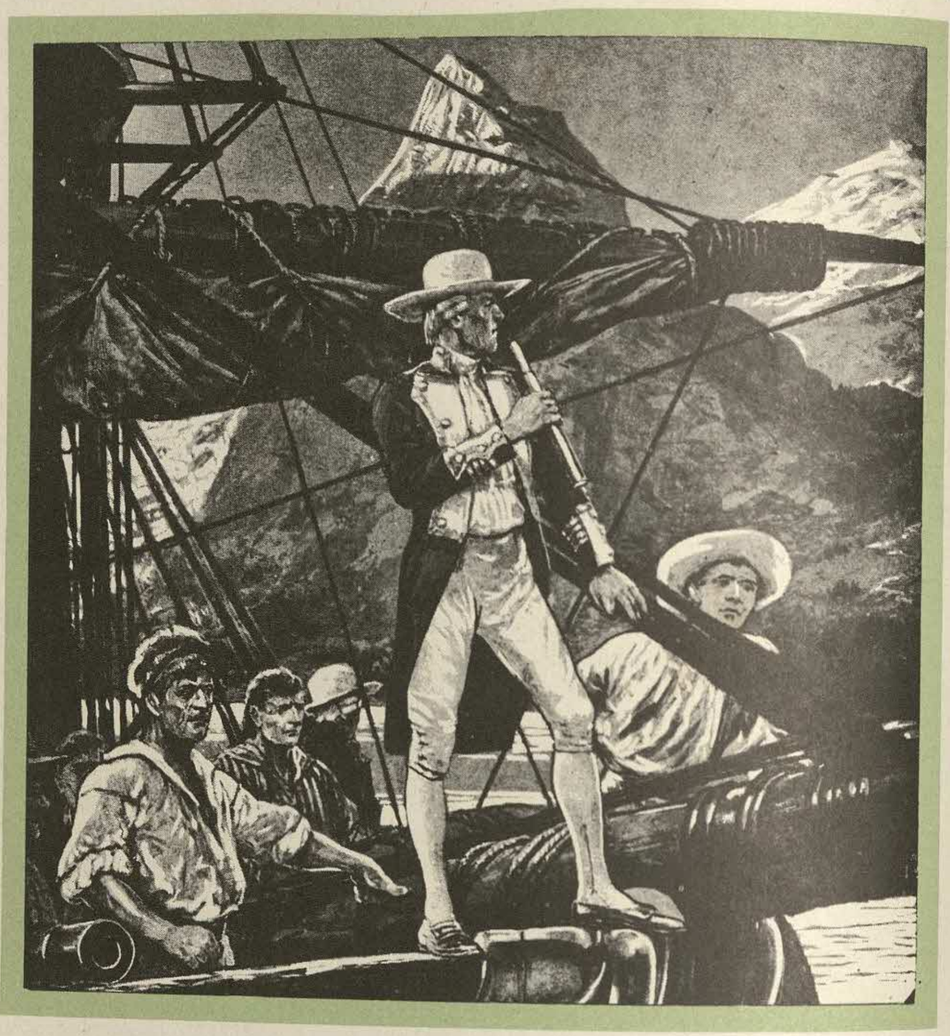
In general, contracts may be either oral agreements or written statements. Sometimes they are sealed. Some types of contracts, such as those involving real estate, must be in writing to be enforced. The written form is preferred by statute law because it contains the exact provisions under which both parties undertook the obligation. Most contracts can be enforced by law. Certain types cannot, however, be enforced, such as contracts which demand excessive interest, those based on misrepresentations or fraud, and those concerning unlawful acts. Agreements are void which do not have the consent of both parties, or which are made with people of doubtful sanity, or which are made with people under twenty-one years of age. In some countries a woman may not make a contract without the consent of her husband.

A contract is ended when the provisions have been accomplished or when both parties agree to dissolve it.

Contracts were included in ancient Roman law and are now a part of English common law. Today there is a complex mass of statutes which protects the parties concerned and makes up a branch of law and legal training termed *contract law.* See LAW.

CONWAY CABAL'. In 1777, during the American Revolution, a plot was organized to displace Washington as commander in chief of the Continental Army. This plot is known as the Conway Cabal because General Thomas Conway was one of the ringleaders.

Washington had been defeated in the battles of Brandywine and Germantown and as a result had lost some of his prestige. The conspirators wished to give the command of the army to the incompetent General Horatio Gates, who had falsely taken credit for the victory at Saratoga. The intrigue, however, was crushed when Wash-



CARRYING THE BRITISH FLAG TO THE SOUTH SEAS

Many British claims to colonies in the Pacific are based on the voyages of the fearless navigator, Captain Cook. To New Zealand he sailed in 1769, mapping and surveying the land, and proving that the country is made up of two islands.

ington learned of it through correspondence between Gates and Conway. Gates, in an attempt to defend himself, disclosed the details of the plot. See CABAL.

COOK, JAMES (1728-1779). Because of the voyages of this foremost English explorer, Australia and New Zealand are included today in the British Commonwealth of Nations; also, the maps of the world were more accurate at his death than at any previous period. He was born at Marton, in Yorkshire. Young Cook rose to the rank of mate in the service of a firm of shipowners, and at the age of twenty-seven joined the British navy.

In 1759, as sailing master of the *Mercury,* he was sent to America to chart the Saint Lawrence River and the coasts of Newfoundland and Labrador. Because of the accuracy of his survey, he was promoted to the rank of lieutenant and given command of a scientific expedition to the

Pacific, under the auspices of the Royal Society. On this voyage he stopped off at New Zealand, studied and named New South Wales, and returned to England by way of the Cape of Good Hope. Soon after, as naval commander, he made a second voyage to the Pacific, during which he completed the charting of the Australasian region. He was then promoted to the rank of captain.

On a later expedition, Captain Cook made a vain attempt to find a northwest passage, but his explorations along the western coast of North America, including the Bering Strait and Alaskan coast, were of great importance in adding to the world's geographic knowledge of that region. On this voyage he rediscovered the Sandwich Islands, now the Hawaiian Islands, where he was killed. One of his ships was stolen by the natives from a Hawaiian bay. He returned with a few of his men to claim it, and a fight began. As he turned to signal his ship for reinforcements, a native crept steathily toward him, stabbing his back.

Captain Cook is also remembered for his achievements as a naval physician. In a period when seamen suffered much from ill usage and disease, he was humane and intelligent in his treatment of his men; scurvy, the scourge of the British sailor, was almost unknown on his ships.

Smithsonian Institution

COOKING LEADS TO CULTURE

The use of fire in preparing food reduced the time man had to spend eating his meals, because cooking breaks down amino acids in food. This gave man extra time to spend on other activities.

COOKING. Although it has many variations, cooking is generally considered the art of preparing food for the table by the use of heat. Few people in this modern world realize its importance; yet, next to the production of food, cooking is probably the world's most important activity. Imagine how unpalatable a piece of raw beef would taste, and you will have some idea of how important the art of cooking is in our daily lives.

How Cooking Began. Very little is really known about the origin of cooking. It probably came about accidentally as long ago as the Stone Age, some time after the discovery of fire.

History does tell us that the early Greeks cooked at least a part of their food, borrowing this custom from Asiatic tribes. Later, cooking was commonly used by the Romans. During the Renaissance, Italian cooks were encouraged to go to France, and great advances were made in the art of cooking.

During the reign of Louis XV, who was a connoisseur of foods, the art of cooking advanced by leaps and bounds. In fact, so well pleased was he with the development of cooking that he awarded the *cordon bleu,* or Blue Ribbon, to a woman chef. That was the highest honor that the Bourbon kings could bestow. Since that time the art of fine cooking has spread to all nations, although the French chefs are generally conceded to be the world's most expert cooks.

How the Indians Cooked. Nearly all the known methods of cooking were used by the American Indians, although in crude form. These people roasted strips of meat by hanging them on pointed sticks over an open fire. To bake, they lined a hole in the ground with stones, on which they built a fire. After the fire died out, they raked away the ashes, placed the food on the hot stones, and covered the pit to hold the heat. Occasionally they baked by covering the meat or other food with corn shucks, plastering the whole with clay, and leaving it in the fire for several hours. This method is used today by experienced campers. The Indians never developed the art of frying foods, their nearest approach being the placing of food on a flat stone over a fire.

Boiling was done by lining a hole in the ground with buffalo skins filled with water and then dropping in hot stones to keep the water boiling long enough to cook meat. Certain Indian tribes steamed food by suspending it over a pot of boiling water. Others lined holes with hot stones, then threw in wet leaves to create steam, first covering the hole to retain the hot vapors.

Why Food Is Cooked. Dentists tell us that if people ate raw foods there would be much less tooth decay. Why not, then, eat only raw foods? To begin with, cooked foods taste better than do raw foods. Moreover, they are easier to digest, they are more pleasing to the eye, and, finally, bacteria are destroyed by cooking. More variety is possible, and often cooked food has more food value because of better flavor and digestibility.

What a Cook Should Know. Almost anyone can cook in some way or another, but to cook scientifically and intelligently is a real art and science. First of all, a cook must know food standards, the little differences that make one grade of flour better than another, or just why one cut of beef is superior to another.

She must know proportions, for example, how much shortening is necessary to make a good piecrust. The amateur cook must make measurements to get this proportion accurately; the expert knows from experience just how much is necessary. A good cook must also know her tables of measures and weights, so that she may compute, for example, just how many tablespoons of shortening make a cup. She must also have a knowledge of what foods mix poorly and how to make this mixing easy.

An efficient cook knows the art of serving foods in the most attractive and appetizing manner. She must know market values of foods and attempt to keep costs down by knowing how best to make use of "leftovers." And, once food is in her kitchen, she must know how to keep it from spoiling. Above all, she must have a thorough knowledge of how to bring variety into a meal and still maintain what is known as a *balanced meal.*

A Balanced Meal. Every well-planned meal contains a variety of foods that furnish not only energy but the proper amount of vitamins, along with the proteins, fats, starches, sugars, and minerals our bodies should have. A good cook will vary her choice of foods daily, always keeping in mind the fact that these ratios must be maintained. Variety can often be attained by cooking the same foods in different ways.

In connection with the planning of healthful, well-balanced meals, a new science known as *dietetics* has come into being. Cooks and dietitians often work hand

COOKING: ROMAN STYLE

The Greeks acquired luxurious tastes in cooking from Asia and passed them to Rome, where the art of fine cookery was highly developed in the time of Lucullus, the epicure.

in hand, for the cook is an expert in preparation, the dietitian skilled in the chemistry, vitamin content, and classification of foods. Dietitians are usually college graduates who have studied foods and food preparation. They will be found in every hospital, many large hotels, and in some restaurants and cafeterias of large city schools.

Methods of Cooking. The transmission of heat to food by some means is a process usually employed in cookery. However, it must be remembered that we speak of preparing frozen desserts as a part of cookery, and this is a process of removing heat from food rather than applying it. Nevertheless, in considering methods of cooking, we think usually of the application of heat. Heat is carried from fire to food through a metal, as in the use of a hot skillet or griddle. Or the heat may be transferred through a liquid, as in boiling. Again, food may be heated by means of hot metal heating air, which in turn heats the food, as in oven roasting. The principal methods of cooking are boiling in various ways, broiling, roasting, baking, braising, frying, and sautéing.

Boiling. There are interesting things to know about boiling. Many people think that to cook something quickly, the thing to do is to have it boil hard. Now, it is interesting to note that after the water is actually boiling (that is, when the bubbles are coming to the surface and breaking), allowing the water to boil faster does not increase the temperature at all. All that it does is to waste fuel. This does not mean, however, that there is never a time when it is desirable to boil things fast. It is done

American Gas Association

"THE LATEST THING" IN 1910

This 1910 kitchen was equipped with a four-burner gas stove with oven and broiler. The cook had to guess at oven temperatures, until the thermostat was added in 1915.

whenever one wishes to evaporate something as, for example, in making a syrup or in condensing the water in which vegetables have been cooked, so that it can all be served with the vegetables.

While boiling water hard does not increase the temperature, it is possible to do this by adding to the water some substance which will dissolve in it like salt. As long as the substance will continue to dissolve, the temperature will increase, but as soon as the water becomes saturated, that is, will take up no more of the substance, the temperature ceases to rise. This knowledge is sometimes made use of in the case of cooking in a double boiler. If some ordinary rock salt is added to the water in the lower part of the boiler, the temperature of the material in the upper part will be increased.

Simmering is cooking in water just below the boiling point. The bubbles form slowly and break just beneath the surface. *Stewing* is really a form of boiling, but usually employs a very small amount of water. Meats are frequently cooked by this method. *Steaming* is cooking by means of the steam which rises from boiling water. *Parboiling* is part boiling; that is, the food is not boiled until done, but simply boiled until it is heated through or partially cooked. Parboiling is frequently employed in the process of serving baked ham. *Scalding* is pouring boiling water over an article, but not cooking it further in that water. Tomatoes are usually scalded in order to have them peel easily.

Broiling. This was probably one of the first methods of cooking employed, if not the first, since it required little in the way of utensils. Broiling consists of cooking before, over, or under radiant heat. The food which is to be cooked is usually placed on a greased broiler and set close to the heat. When one side of the food is cooked, it is turned over and the other side is exposed to the heat until done. This method of cooking is one frequently employed for meat, fish, and poultry.

Sometimes meat is cooked in a hot skillet without any fat. This method is called *pan broiling*.

Roasting. By this is meant cooking near fire, but in the presence of a piece of metal which acts as a reflector. However, now that we no longer cook in open fireplaces, this method is rarely used except in out-of-door cooking, and the term *roasting* has come to be used of cooking in an oven, particularly meats.

Baking is cooking in an oven. The product is baked both by the hot air and by the heat of the pan in which it stands. Many kinds of vegetables and meats, as well as breads, cakes, and pies, are prepared by baking. During baking, excess moisture is evaporated from the food.

Braising. This is a combination of frying and simmering. It is a method used with meat which needs long, slow cooking to make it tender. The meat is cooked in fat until it is brown. Then a small amount of water is added to it, the pan is tightly covered, and the meat is allowed to simmer slowly until it is done. Pot roasts are often cooked in this way.

Frying. This is cooking a product in deep fat. Many different fats may be used for frying purposes, but the best are the ones with the highest burning points (those which catch fire least easily), since food may be cooked through more certainly without burning. Butter has a very low burning point, while olive oil and some of the fats made from vegetable fat have high burning points.

Sautéing. This is frying in a small amount of fat, not enough for the product to be immersed. Food cooked this way tends to absorb more fat than when cooked in deep fat. When being sautéed, the food is usually cooked on a griddle or in a skillet and turned from time to time.

Modern Cooking Equipment. Within recent years, many practical inventions have made cooking tasks lighter than ever before. Electrical appliances, such as percolators, toasters, waffle irons, and grills, make it possible to prepare breakfast at the table. In fact, the housewife can cook complete meals anywhere she chooses with the aid of electric skillets, portable broilers, and rotisseries.

Pressure cookers make for unusually quick cooking of foods that formerly required hours to prepare. Under old-fashioned methods of cooking, water could

ELECTRONIC RANGE KEEPS COOL

A meal is prepared in a hurry with electronic microwave cooking. Utensils remain cool because the oven reflects the microwaves, and the dish transmits them. Only the food absorbs the waves and becomes heated. Food can be cooked in the same dish in which it is served. This bacon was broiled in two minutes on a paper napkin and paper plate.

Tappan Stove Company

never be heated above 212°, for at this temperature it turned to steam and escaped. In the pressure cooker, however, the temperature may be easily raised to 240° or more by keeping the steam confined under pressure. A safety valve releases excess steam. Not only cooking, but home canning, can be done with the pressure cooker. Tough cuts of meat, steamed bread, beans, and many other long-cooking foods may be quickly cooked.

Another aid to the housewife is the oven-regulator, a device that keeps the gas flame in the oven at a fixed temperature for an indefinite period. This allows the housewife to go about her other tasks without fear that her baking food will burn.

Waterless cookers, also, have come into use in recent years. They are made of heavy aluminum. Foods placed in them will not burn but will cook in their own vapors, no water being necessary.

Outdoor Cooking. See CAMPS AND CAMPING.

Foods of all Nations. Every nation has its own peculiar style of cooking. The English are great lovers of roasts, particularly beef. French cooks are famous for their pastries and soups. Italian dishes, such as spaghetti, vermicelli, and ravioli; Swedish smorgasbord; Russian caviar, and German Thuringer sausage are examples of typical European foods. All these foods are found in American cities in restaurants operated by natives of European countries; or such foods can be prepared in the home by any good cook.

Consult the titles below for additional information. See, also, articles on the various grains, vegetables, fruits, nuts, meats, and fish.

Bread
Butter
Cacao
Calorie
Canning
Carbohydrate
Cheese
Chocolate
Coffee
Diet
Digestion
Egg
Flour
Food
Home Economics
Meat
Meat Packing
Proteins
Pure Food Laws
Starch
Sugar
Tea

COOLIDGE, CALVIN (1872-1933). On August 3, 1923, Calvin Coolidge, a quiet, serious, economy-loving native of Vermont, became the thirtieth President of the United States. He succeeded Warren G. Harding, who had died the day before at San Francisco, Calif. Thus began an era in American history that was to be noted for unprecedented prosperity — six years that were to witness the marvelous spread of radio to millions of homes, and the amazing flights of daring aviators across oceans and wastes—a period that was to become known as the "Coolidge Era."

When Coolidge became President, few people knew much about him. They knew that he had distinguished himself by ending the Boston police strike of 1919; that he had been nominated for Vice-President on the first ballot at the Republican National Convention in 1920, and had been elected with Harding. But aside from these bare facts, they knew little about his life.

Education and Early Career. This man who was to hold the highest office in the land was born in 1872 on July 4, Independence Day, at Plymouth, Vt. He was educated in local schools and at Amherst College, from which he graduated in 1895. Ten years later he married Miss Grace A. Goodhue, after having begun the practice of law in Northampton, Mass. Two years later found him beginning his political career, as a representative in the Massachusetts state legislature. In 1910 Coolidge was elected mayor of Northampton, and in 1912 he was elected to the state senate and became president of that body in two years. His star rose rapidly then.

From 1916 to 1918 he was lieutenant-governor of Massachusetts, and from 1919 to 1920, governor. It was during that time that the Boston police went on strike, and the city was left without protection. Since the police department was an arm of the state, Coolidge dealt with the problem, ended the strike, and, as a result, became known throughout the country.

A year later this fame bore fruit, and he was mentioned for President. But he was opposed by several powerful men in the Republican party and had to be content with the nomination for Vice-President. Then, two years after he took office, he was raised to the Presidency.

The inauguration of President Coolidge was not an elaborate affair. On the contrary, it was a simple, quiet ceremony in his boyhood home, in the presence of his family and a few friends. The oath of office was administered by his father, a notary public. Immediately afterward, Coolidge assumed the duties of his new office.

Library of Congress

CALVIN COOLIDGE
Thirtieth President of the
United States
Administration, 1923-1929
Backed by a long career of efficient public service, President Coolidge did much to promote American prosperity, but failed to bolster falling farm incomes. He was probably best known for his efforts in behalf of international peace.

His Administration. Coolidge's years in office were uneventful so far as legislation was concerned. He urged economy and caution in government, and, with this in mind, twice vetoed the McNary-Haugen farm bill because he believed it unworkable, and a bonus bill for World War I veterans because of the expense. The great surplus being amassed each year from government revenues he applied to the national debt and won for himself wide popularity for tax reductions.

Three members of his Cabinet, Frank Kellogg, Secretary of State, Herbert Hoover, Secretary of Commerce, and Andrew Mellon, Secretary of the Treasury, were aggressive heads of their departments, creating a spirit of stability and optimism in the nation.

Probably the outstanding political event of his first years in office was the disclosure of the Teapot Dome scandal. This scandal was not a reflection on him personally, but it did involve several of his Cabinet members who had been appointed by Harding.

In 1924, over the objections of the farm bloc, Coolidge was nominated for President by the Republican party. In the election of that year he defeated John W. Davis, the Democratic nominee, and Robert LaFollette, the Progressive candidate. During the next four years, taxes were further reduced, flood-control bills were passed, and several senatorial investigations were carried forward.

But the greatest progress was in the field of science. Radio became an established fact in the lives of the American people. Motion pictures, which hitherto had been silent, began to appear with sound accompaniment. The automobile industry developed new safety devices and turned out better and safer cars yearly. Charles A. Lindbergh flew the Atlantic, followed by other Americans. Admiral Byrd flew over the North Pole. Telephone communication between America and Europe was begun.

Economically the nation was enjoying great prosperity, and despite Coolidge's advice to economize, the American people were spending more money than ever before in peace times. In foreign relations, few troubles appeared.

"I Do Not Choose to Run." When Coolidge's administration was coming to a close, he was asked to run again for President. Never a man of words, Coolidge answered this request with the statement, "I do not choose to run." People speculated as to what he meant; but, when 1928 came, he clearly indicated that he would not accept the nomination again. Instead, at the Republican convention, he threw his support to Herbert Hoover, who defeated Alfred E. Smith, the Democratic candidate.

As Ex-President. Coolidge decisively supported Hoover again in 1932, but by then the economic depression had wiped out his popularity, and his voice had little power in the election. In his years of retirement, Coolidge wrote his autobiography and articles for magazines. Then, in 1933, when the "Coolidge Era" of prosperity was but a wistful memory in the minds of the people, he died. He is remembered as a sincere, honest, simple, and industrious man who preserved in the White House the homely traditions of New England.

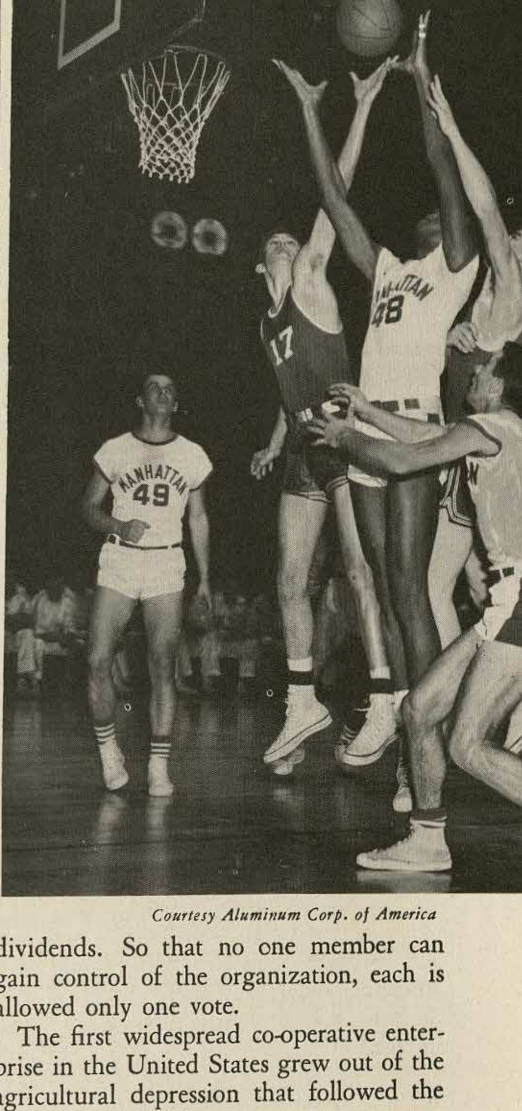
COOPER, James Fenimore (1789-1851). The first American novelist to be read and enjoyed outside his own country, James Fenimore Cooper is remembered for his delightful, stirring tales of the frontier and the sea. His writing, forceful and full of action, seems to improve with translation into foreign tongues. Children in many different lands are familiar with Natty Bumppo, Cooper's famous woodsman and trapper.

Born in Burlington, N. J., Cooper was brought up on his father's estate at Cooperstown, N. Y., near beautiful Otsego Lake. This region was then typical frontier country, and the boy learned from personal observation the ways of Indians, forest scouts, and pioneers. He was sent to Yale College at the age of fourteen, but his teachers saw no signs of literary talent, and his work was so poor he was expelled in his junior year. He then entered the navy, and for three years was in active service, storing impressions that made his stories of the sea so vividly realistic.

After Cooper left the navy, in 1811, he settled down as a farmer in Westchester County. His first literary venture was more or less accidental. One day, while reading an English romance, he remarked to his wife that he could do better himself. Setting words to action, he produced a story called *Precaution.* This novel of the English aristocracy was so outside his field it failed at once, but Cooper was encouraged to try a theme closer to his own experiences. Accordingly, in 1821, he wrote his first successful pioneer story, *The Spy,* in which he introduced the forcefully drawn character Harvey Birch.

WROTE LEATHER-STOCKING TALES
James Fenimore Cooper's frontier novels thrill children throughout the world. His portrayals of Indian life rank with the best.

This was the beginning of a literary career that gave James Fenimore Cooper the name "American Scott." His *Leather-Stocking Tales,* centering about Natty Bumppo, include *The Deerslayer, The Last of the Mohicans, The Pathfinder, The Pioneer,* and *The Prairie.* This series and two fine stories of the sea—*The Pilot* and *The Red Rover*—represent Cooper at his best, for they are fascinating narratives dealing with a colorful epoch of American history. Though Cooper was not always historically accurate and his style was faulty, his gift of telling a story, his vivid descriptive powers, and his creation of such characters as Natty Bumppo and Harvey Birch give him a high place among American novelists.



U.S. Army; United Press

Courtesy Aluminum Corp. of America

CO-OPERATION HELPS EVERYONE

From gun crew to basketball team, all undertakings involving more than one person depend upon co-operation for their success.

CO-OPERATION, *ko op ur a'shun.* Almost from the beginning of the human race, people have realized the advantages of co-operation, or working together toward a common end. For example, they have labored together in groups to accomplish more with less effort, they have waged battle together against a common enemy, and they have lived together in communities for the common good. But so desirous have individuals been of getting as much profit as possible for themselves that only in modern times has industrial and marketing co-operation been considered worth trying.

In the early part of the nineteenth century, Robert Owen, in England, first showed that co-operation between employer and employe is possible. He began the work from which grew the co-operative society, giving its members certain advantages in buying, selling and borrowing.

A little group of English workmen living in the town of Rochdale organized the first consumer co-operative in 1844. The principles by which they ran their society have been the basis on which every successful co-operative has since been run.

The outstanding features of this plan are that all goods are sold for cash at the market price and that the savings made between the selling price and the cost go to the members in the form of patronage dividends. So that no one member can gain control of the organization, each is allowed only one vote.

The first widespread co-operative enterprise in the United States grew out of the agricultural depression that followed the Civil War. Earlier attempts at co-operation had been made, but they lasted only a short time because of poor planning and lack of effective leadership. The Grange of the seventies and the later appearance of the Farmers' Alliance and Equity were all attempts at economic reform. These groups established co-operative grain elevators, flour mills, stores, and warehouses and for a time brought substantial gains to the farmers. By the end of the century, however, many had collapsed because they suffered from bad management or other unfavorable conditions.

It was not until the early years of the twentieth century that the idea emerged that a co-operative society should be consumer-owned and consumer-controlled. The farmer still believed that his salvation lay in co-operation, and each attempt that he made came a little closer to the ideal. Finally, in 1910, a group of Finnish laborers in Waukegan, Ill., started the first modern consumer society based on the Rochdale principles.

Consumer co-operatives really took hold during World War I and grew steadily up to the time of the economic collapse of 1929. During the depression, co-operatives had a tremendous growth. In the United States alone, there are now thousands of co-operatives, handling millions of dollars' worth of goods annually.

The consumer co-operative has become an important factor in economic life because it reduces the cost of living. The way such a society achieves this end can be seen in the example of a co-operative started by a group of Minnesota farmers in 1921. These men, unwilling to pay the high prices for gas and oil needed to run their farm machinery, contributed money to build a filling station and to purchase gas and oil from the wholesale dealer. The society bought oil at wholesale prices and sold it to its members at the market price. At the end of the year, the savings thus made were returned to each member according to the amount of his purchases. Thus the farmers received the profit which usually goes to the middleman. Although some farmers contributed more money than others and thus held more shares of stock, each was allowed only one vote in deciding the policies of the society.

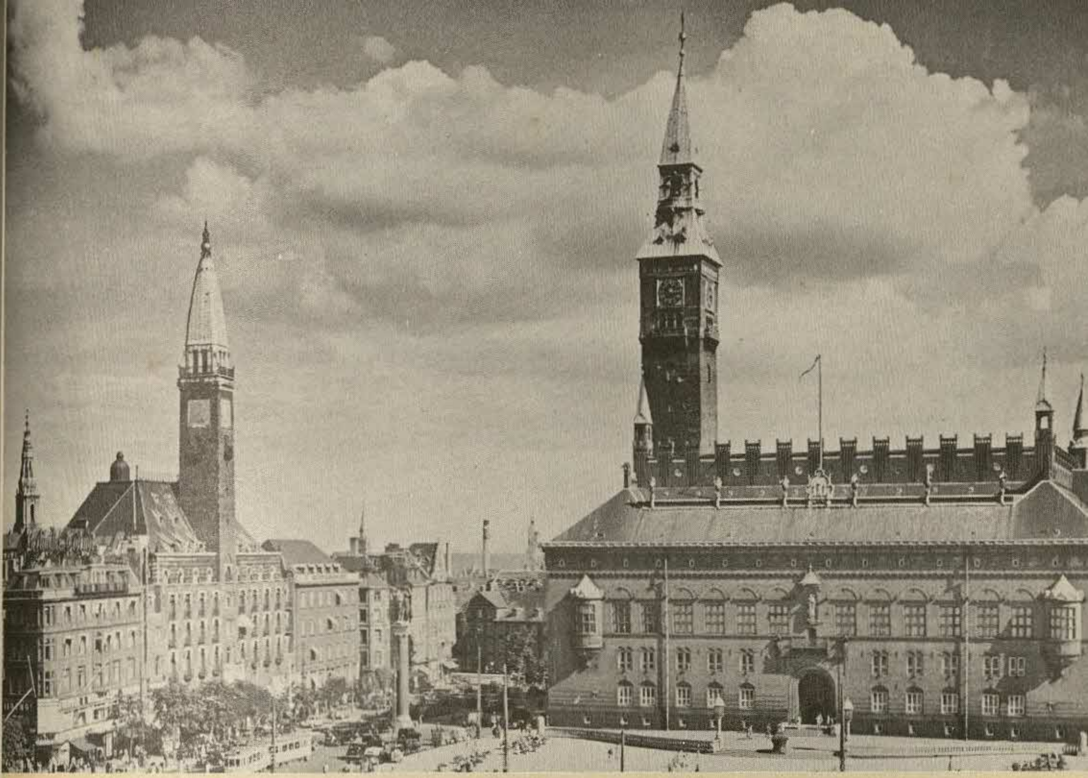
Most of the consumer co-operatives in the United States were begun in this manner, and all are run on this plan. Co-operatives of this type have been successful in Canada and have been highly developed in the Scandinavian countries, the Netherlands, Belgium, France, and Great Britain. Many co-operatives have proved so successful that they have been enlarged and now handle all the supplies that the farmer needs. Farmers also have organized co-operative banking and credit groups to assist them in borrowing money when needed.

Another type of co-operative found in the farming sections is the marketing society. These groups act as agents to sell the farmer's products. Organized chiefly under the American Farm Bureau Federation, they seek to increase the quality of the farmer's goods, eliminate waste in distribution, and find the best markets. The agencies marketing the citrus fruits of California are among the most famous in the country. Marketing societies sell cotton and tobacco in the South; grain, livestock, dairy products, and fruit in the Middle West. Canadian co-operatives market great quantities of wheat.

Co-operatives, however, are not restricted to farming communities. In those countries where they have been developed, consumer co-operatives have been organized in towns and cities for selling groceries, bakery goods, gasoline and oil, books, and other products. Credit unions, for saving and borrowing money co-operatively, also are found in many cities.

COOT, *koot,* **or MUD HEN.** This duck-like water bird belongs to the rail family. It has a thicker bill than a duck, and its toes, instead of being webbed, have large, rounded flaps on each joint. The bird is about fifteen inches long, slaty gray in general color, with a few white markings around the edges of the wings and under the tail. The coot is found throughout North America, the northernmost birds moving south in the winter. It is rather rare on the Atlantic coast during the nesting season. It lives on marshy ponds and lakes where there are thick, reedy growths in which it can hide.

The food of the coot consists of mollusks, crustaceans, insects, and various water plants and their seeds found in the mud. The nest of old reeds is built up in shallow water. The coot is an expert swimmer and diver, but rather awkward in the air. It is often hunted, and sportsmen call it by a great variety of names, such as *blue peter, meadow hen, hen bill, crow duck,* etc. The flesh is edible, and as good as most ducks.



Inga Aistrup

CIVIC CENTER OF THE DANISH CAPITAL

Sometimes called the "Paris of the North," Copenhagen offers a charming blend of ancient and modern architecture. The Town Hall, built in 1905, like much of the city, was undamaged during World War II. The spired building to the left is the Palace Hotel.

COPENHAGEN, *ko pen ha'gen,* DENMARK. The largest city in Denmark and capital of the country, Copenhagen is situated on the east coast of the island of Zealand. Some of the suburbs, however, are on the little island of Amager across a narrow channel.

With the Swedish coast only fifteen miles to the east and Germany seventy-five miles to the south, Copenhagen has become not only a leading Baltic port, but a vital rail, air, and distributing center for Northern Europe. The city is celebrated for its tremendous water commerce. In fact, the name Copenhagen means *Merchant's Haven.* The population, including suburbs, is more than 1,000,000.

Copenhagen radiates from an irregular square called Kongens Nytorv, where a number of streets converge. Near the square are four palaces, the most imposing being the Christianborg, which serves as a parliament, court, and foreign office. The famous Rosenborg Palace, now an art museum, is in Copenhagen. The National Museum is known for its archaeological collection. The Royal Library contains one of the best collections of ancient manuscripts in Europe. The University of Copenhagen, with a fine collection of old Norse documents, is the oldest in Northern Europe. The Church of Our Lady, rebuilt after a British bombardment in 1807, is the most famous of the numerous cathedrals. A royal summer residence of the monarch is at Bernstorff, a suburb.

Conspicuously clean, the city has been given a modern air by the razing of old fortifications which have been replaced by great parks, fine residences, and boulevards. Everywhere prosperity, industry, and literacy are apparent among the citizens. Principal industries include shipbuilding, iron foundries, pottery making, brewing,

A MAN NOT AFRAID OF NEW IDEAS

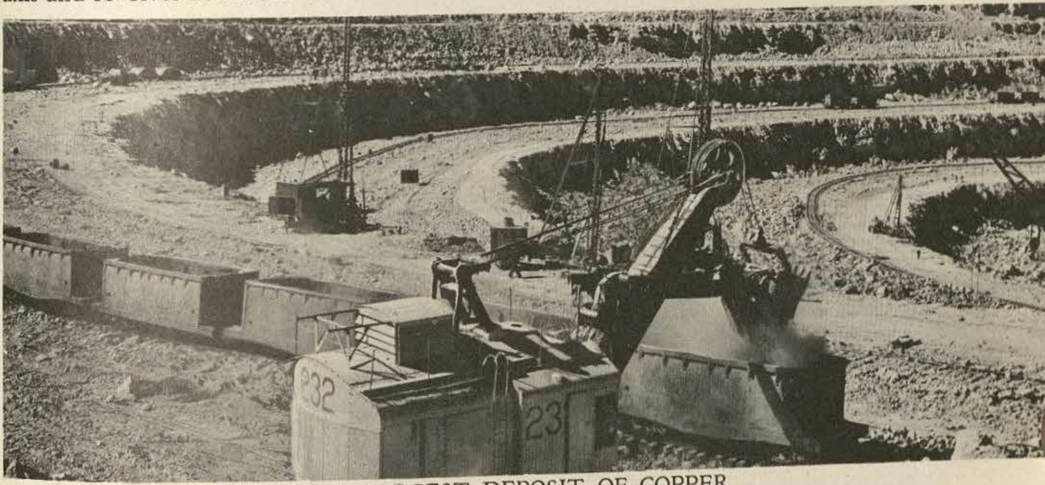
Copernicus believed that the sun is the center of the solar system and that the earth, like other planets, revolves around it. Other astronomers in his day taught that the sun revolved around the earth. For twelve years Copernicus dared not publish his theory.

fishing, and, of course, shipping and distribution of products.

Historically, Copenhagen dates from 1043, but it first became of note in 1167, when Bishop Absalon of Roskilde built there a castle and fortress as a protection against pirates. The fortress was little more than a great monastery until 1443, when it was made the capital of Denmark. During the Middle Ages the Hanseatic League continually besieged the city, which also took part in the long wars of the Reformation. When Denmark became an ally of Napoleon, Copenhagen was shelled by the British fleet. In World War I, Denmark was neutral; but during the second World War, from 1940 to 1945, Germany occupied Denmark.

COPERNICUS, *ko pur'ni kus,* NICOLAUS (1473-1543). Modern astronomy is based on a theory first announced by Copernicus. His theory was that the sun is the center of the solar system, and the earth, like the other planets, turns on its axis and revolves about the sun. This idea is contrary to the theory of Ptolemy, an astronomer who lived in Egypt about A. D. 140 and who was regarded as an authority Ptolemy had believed that the earth is stationary, the center of the universe, and that the sun, moon, and stars move around it. As soon as astronomers began to understand and test the Copernican theory, that of Ptolemy was discarded.

Copernicus was born at Thorn, Poland. He studied medicine at the University of Cracow and later became interested in mathematics. At Bologna, Italy, he later studied Church law and astronomy. Returning to Poland in 1505, he was made a canon in the Cathedral of Frauenburg, where he divided his time between giving medical care to the poor and working out his new system of astronomy. His book, *Concerning the Revolutions of the Celestial Spheres,* was completed in 1530, but because of opposition to his theory, publication was delayed for thirteen years. The first printed copy was placed in his hands a few hours before his death.



WORLD'S LARGEST DEPOSIT OF COPPER
At Chuquicamata, Chile, a huge open-pit mine helps supply global needs for copper.

COPPER. Thousands of years ago, the men of the Stone Age discovered a dull, brownish metal which is known today as copper. They threw away their stone weapons and implements and fashioned others from the new metal. Later they discovered that copper could be mixed with tin to produce a better metal—bronze. And thus began the Bronze Age.

Copper is a metallic element. One of the earliest sources of the metal was the island of Cyprus, where the Greeks and Romans

Right, Courtesy American Brass Co.

SHINING INGOTS FROM JAGGED LUMPS

Copper, often found free in nature, sometimes occurs in huge chunks like this (left), which is two by three feet. For industrial use, copper is refined and cast into ingots (above).

obtained their supply. The Romans called this island *Cuprium*, and it is from this word that copper gets its name. Its symbol, *Cu*, is also from the Latin term. Another early source of copper was Spain, where the Iberians used it extensively. The Moors and Phoenicians, who later invaded the country, forced slave gangs to operate the copper mines.

Where the World Gets Its Copper. Copper has been discovered and produced in paying quantities in at least twenty countries. The world production is now several billion pounds yearly. In the United States, by far the largest producer, much of the supply comes from the great open-pit mines of Arizona, Montana, Michigan, and Utah. Chile ranks second. In Canada, another top producer, the mines of British Columbia, Ontario, and Quebec are noted. Northern Rhodesia and the Belgian Congo are among the world's greatest suppliers. Other important producers include Russia, Germany, Japan, Mexico, Yugoslavia, Peru, and Australia.

The demand for copper varies, depending upon the demands of industry. Because it is used for war materials, the existence of war and costly preparations for war have great effect on the price of the metal.

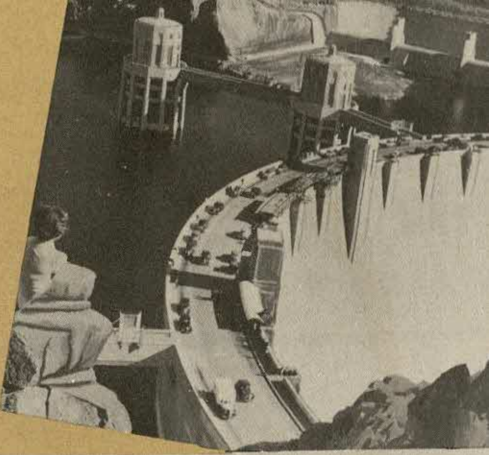
The United States faces a serious copper shortage, since known deposits are rapidly being worked out. Naturally, the government is taking steps to conserve the supply. One of the means used to combat this shortage is the recovery of copper from scrap metal.

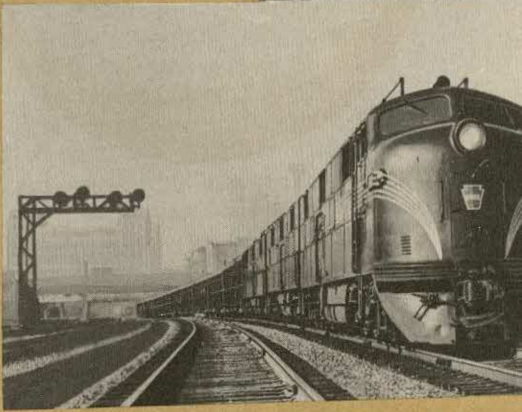
How Copper Is Obtained. Sometimes copper is found in a pure state; sometimes it is combined with iron, silver, oxygen, or carbon. Copper may be obtained by smelting the ore in a special furnace with a proper flux — material used to purge the metal of impurities. When copper sulfide ores are used, this smelting process produces a molten mass of copper and iron sulfides and silica, called *matte*, and slag, which consists of the waste materials combined with the flux.

The matte is then reduced to crude copper in a Bessemer converter. This copper, generally known as *blister copper*, is purified by electrolysis, a method whereby the blister copper is put into a solution and dissolved. The pure copper is carried away and deposited on plates by electricity, the impurities dropping to the bottom of the tank. See ELECTROLYSIS.

The Metal of a Thousand Uses. Copper is perhaps the most useful of metals. Much of its usefulness is due to the fact that it is extremely easy to work. It can be drawn out into thin strands or rolled into flat sheets. It is reasonably hard and is easily combined with other metals into alloys. Furthermore, it will take a high polish or luster.

Almost everyone knows that copper is used in making pennies and other coins,





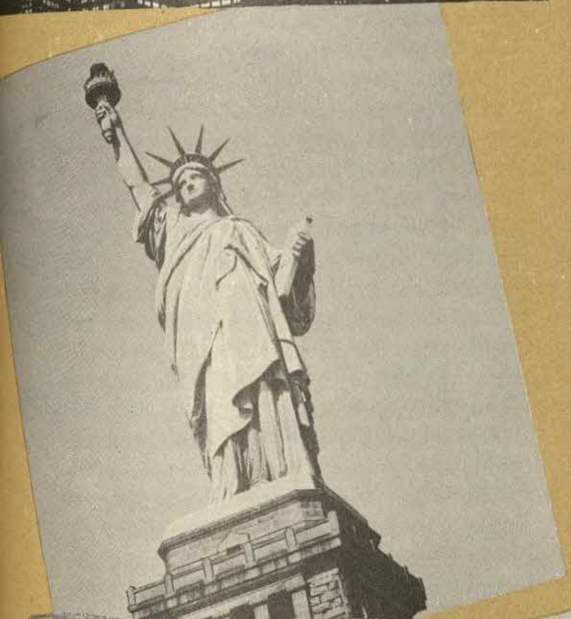


Photo by Charles Phelps Cushing; Pennsylvania Railroad Photograph; NYSPIX; Rotkin, P.F.I.; Copper & Brass Research Association

AN OLD METAL IN A MODERN WORLD

Copper is used in simple homes and in great skyscrapers (top left), in kitchen appliances and hydroelectric plants (top right), in the Statue of Liberty (left), and in Diesel locomotives (above). It is obtained from mines like the huge open-pit mine shown below.

but this is not the chief use of the metal. Fully fifty per cent of the world's copper goes into electric wire or electrical machinery, because copper is a fine, low-priced conductor of electricity. Cooking utensils, shell cases for ammunition, bronze, brass, and gun metal are everyday uses of copper. It is also used in making dyes, printing plates, and colored glass. Numerous chemical compounds are made with copper, including blue vitriol used in making batteries for telegraph work, and Paris green, a poison for spraying plants infested with insects.

These are but a few of the most common uses of copper; every day chemistry and industry are discovering many others. See Bronze Age.

COPPERHEAD. A close relative of the water moccasin, the copperhead is one of the most poisonous snakes found in America north of Mexico. While the moccasin lives most commonly in swamps, the copperhead is found most frequently in the highlands. In fact, it is sometimes called "highland moccasin." The name copperhead is properly given the snake because of the coppery color which the head quite frequently but not always possesses.

The body of the snake is commonly brown above, with large, usually distinctly outlined chestnut crossbands. The color beneath is for the most part pinkish white. Sometimes the copperhead snake is grayish rather than brown.

The length of this snake is usually less than a yard. The copperhead's tongue is usually red at the base, with the forked portion white. It is not the tongue, however, which inflicts wounds or pierces the skin of the victim. This work is left to the fangs, which are comparatively short, but are capable of inserting a fairly powerful poison into any animal the snake attacks. Usually the copperhead prefers to escape from man rather than fight, and need not be feared unless cornered.

The snake may be found from Massachusetts to Northern Florida and west to Illinois and Southern Texas. It is no longer abundant, but in some places is more so than it ought to be. Its food is largely mice, frogs, and birds.

The young are not hatched from eggs, but are born living. The broods vary in number from six to nine. The young snakes have tails of brilliant yellow, but by the third year this color is usually lost. The young are commonly born late in the summer.

COP'RA. The dried meat of the familiar coconut, copra has great value because of its rich oil, from which soap, candles, and margarine are made. The coconut palm, which bears the large brown nuts, is found in the Philippines, India, the Malay Archipelago, and in most tropical areas.

Copra is an important article of trade and commerce. The white meat of the coconut is dried in the sun or in kilns to prevent its spoiling. It is then shipped in the form of copra. The oil is obtained by first boiling and then squeezing the copra, often by means of hydraulic presses. The pulp that remains makes a rich food for cattle. Nearly twenty-five gallons of oil can be obtained from 1,000 coconuts. See Coconuts.

COPYING DEVICES. Modern business, with its demand for speed and efficiency, would be impossible without copying devices. Thousands of letters and communications to customers and employers must be sent out daily to keep any office organization running smoothly and at a minimum of cost. As a result of this demand, different kinds of copying devices for different purposes have been invented.

The simplest but least efficient as far as numbers are concerned is the typewritten *carbon* paper. This is a sheet of thin paper coated on one side with carbon, which makes an inked impression on another sheet. Five or six copies can be made.

Faster and easier is the *mimeograph*. This is a device consisting of a circular drum upon which a *stencil* is revolved. Ink is furnished from a container on the inside of the drum. It is absorbed in the porous material which composes the drum and which is spread evenly on the stencil. Paper is fed from a horizontal platform, and as the drum revolves, the number of copies is registered on a meter. When the desired number has been reached, a bell rings. The drum may be revolved by hand or by electricity, and automatic feeding devices may be attached to eliminate any human effort. Any number of copies may be made in this manner, and the stencil, which may be cut on the typewriter or with a metal stylus, can be used any number of times.

A *hectograph* is a device for producing a small number of copies, usually less than 100. Gelatin and glycerine are mixed in a flat pan. The original copy is written in aniline ink which, when placed over the gelatin and glycerine, leaves a portion of the ink on the jelly-like matter. Copies are made by pressing paper on this surface.

One of the best copying devices is the *multigraph,* or similar machine, which can reproduce copies of a typewritten sheet so that they appear to be originals. As with the mimeograph, thousands of copies can be produced. These are especially useful when circular letters are sent out. The device is composed of two revolving drums, one of which has slots in it holding type. The type is inked by a ribbon and prints in the manner of a rotary printing press.

Checksigners permit one person to sign many checks at once. The person doing the writing has an attachment on his pen which governs the action of other pens, and, as he writes, the other pens move simultaneously. This is especially useful in large businesses and in government offices. An old copying device, now almost obsolete, is the *letter press,* consisting of a book of tissue paper which receives the impression of a special copying ink.

Camera devices also are used for copying. Duplicates may be made by taking a photograph of a written sheet, map, drawing, or other matter, and reproducing it on sensitized paper instead of a film. Other methods are similar to blue printing and photo-engraving processes. See PRINTING; BLUE PRINT; PHOTO-ENGRAVING.

COPYRIGHT. Guardian of the works of America's authors, composers, playwrights, publishers, and artists is the copyright law, a legal protection provided for in the Constitution of the United States. Under this law, all books, musical compositions, original paintings and other art works, maps, moving pictures, and plays cannot be reproduced except by permission of the copyright owner, or upon payment of a fee. The owner of a copyright is thus protected from having any one else make money by using his property.

Under the United States laws, in order to be copyrighted, two copies of a book, magazine, photograph, or other material included under the law must be sent to the Register of Copyrights, Library of Congress, Washington, D. C. The fee is four dollars, and the work is protected in the United States for twenty-eight years. One year before the copyright expires, application for renewal for another twenty-eight years may be made. In Canada and Great Britain, copyright protection holds for fifty years after the death of the author.

For many years almost all civilized nations, with the exception of the United States, took part in an international copyright exchange. The United States simply maintained private agreements regarding copyright with certain countries. In 1954 the United States copyright law was amended to allow the country to participate in the Universal Copyright Convention. This convention not only extends protection to types of artistic works other than writings, but also provides for copyright relations between nations. Under its terms a work copyrighted in one member nation will be protected in the other member nations. Translations will be copyrighted for terms as long as the original works. The international symbol of copyright is the letter "c" enclosed in a circle, along with the owner's name and the date.

Material that can be copyrighted includes: books, periodicals, lectures, sermons, addresses, plays, musical compositions, maps, works of art, models, reproductions, drawings, photographs, prints and pictorial illustrations, motion-picture photoplays, and motion pictures other than photoplays. Companies maintaining radio stations and using phonograph records are required to pay a fee or seek permission to play a copyrighted musical composition. See PATENT.

CORAL. Imagine an island made up entirely of animal skeletons. That is exactly what a coral reef is. Although the coral found in reefs is a hard, rocklike substance, that is not at all the original form of the animal. When alive, the coral is known as a polyp. It is a soft, jelly-like mass with an interior sac which serves as a stomach. From its body small tentacles, or arms, reach out in every direction to pull in food.

Varieties. Coral animals, or polyps, take many strange shapes. For example, there is the *sponge* coral, in which each little cell is the home of a separate polyp. The *cup* coral, *tree* coral, *fan* coral, *organpipe* coral, *horn* coral, and *brain* coral are so-called because of their peculiar resemblance to the things for which they are named. Scores of other fantastic shapes are to be seen in any large coral reef. Coral varies in color from white to black, through yellow, pink, and red.

Habits. Coral polyps exist for the most part only in tropical or semi-tropical waters. They cannot live in water having a temperature below 60°. Although a few species of coral live as individuals, most of them are parts of a vast colony. A polyp fastens itself to a rock or to a piece of dead coral. Reaching out with its tentacles, it absorbs food and begins to build around itself a shell, made of a lime substance from the sea water. The parent polyp produces small buds which develop into other polyps, and these in turn reproduce still other polyps. In this way, millions of polyps are reproduced. Sometimes a polyp escapes from the parent, fastens itself to a new rock, and begins a new colony.

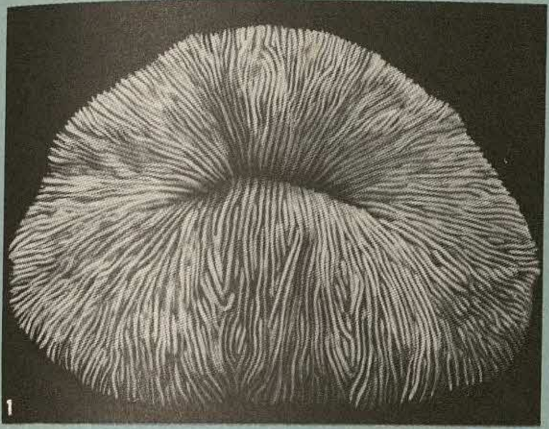
In the course of several years, a vast heap of coral skeletons is built up, cemented together. As this building-up process continues, the mass approaches the surface of the ocean, producing what is known as a coral reef.

Kinds of Coral Reefs. When a platform or stretch of coral reefs extends along the shore, it is known as a *fringing* reef. There are extensive fringing reefs off the Florida coast. If located farther away from the shore so that there is a lagoon between the reef and the shore, the reef is known as a *barrier* reef. Off the coast of Australia lies the Great Barrier Reef, largest in the world. It extends for 1,200 miles. Still another type of coral reef is known as the *atoll*. It is circular in shape and encloses a body of water. It is generally believed that atolls were once fringing reefs around islands which later sank, while the reefs continued to grow.

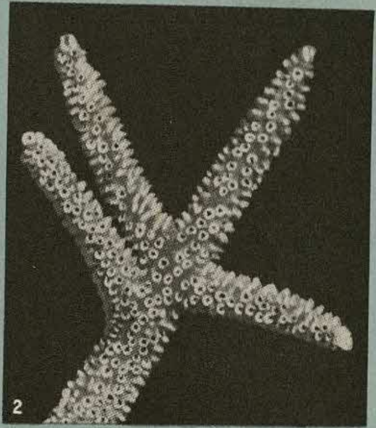
The Coral Industry. The Mediterranean is a source of the pink and red corals, the kind used in making ornaments. The coral is gathered by dragging great grappling hooks along the ocean floor, breaking off chunks of coral, and holding them until they can be hoisted to the surface. These corals take a high polish and are used in rings, brooches, necklaces, and other jewelry. Naples and Genoa are the chief centers of this industry.

COR'CORAN ART GALLERY. In Washington, D. C., there is an imposing marble structure at New York Avenue and Seventeenth Street, which houses one of the finest collections of painting, sculptures, and ceramics in the United States. It bears the name of its founder, William Wilson Corcoran (1798-1888), who also endowed it with a fund of $900,000 for the purpose of honoring American art and encouraging American artists. The original building on Pennsylvania Avenue was opened to the public in 1874. It contained the nucleus of the collection, largely from Mr. Corcoran's works of art, a gift to the city.

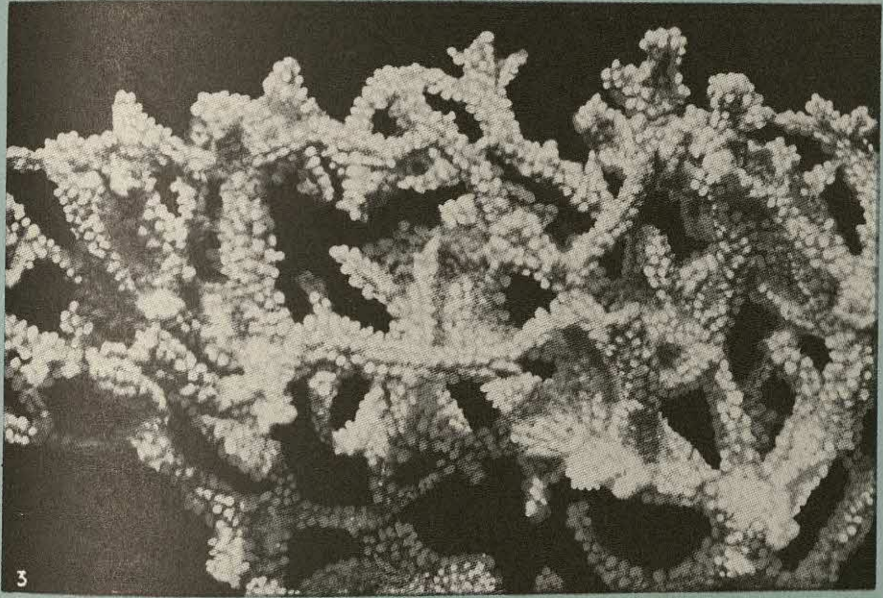
The present permanent collection was transferred to the new structure, designed by Ernest Flagg in the Neo-Grecian style of architecture, when the building was



1



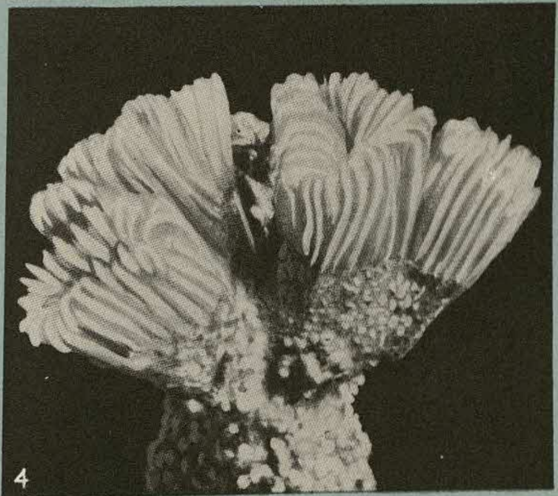
2



3

JEWELRY OF THE SEA

Coral often looks like beautifully formed stone, or undersea mineral. But it comes from marine animals related to the sea anemones. The hard limestone skeletons of these animals form coral reefs found in the ocean. Coral makes attractive jewelry. (1) A spongelike coral found off the Florida coast. Specimens sometimes grow to large sizes. (2) A spiny coral "hand," in which the little openings for food are clearly visible. (3) A section of one of the huge coral colonies which combine to form coral *atolls* and reefs in tropic seas. (4) A cabbage-like coral, with paper-thin tentacles surrounding each mouth.



4

United Press

HOME OF ART TREASURES

This painting of Abraham Lincoln at the Corcoran Art Gallery is said to be his last portrait before he grew a beard.

completed, in 1897. Exhibits of American artists are held twice a year, and a school of art is maintained in connection with the gallery. One of its outstanding pieces of sculpture is *The Greek Slave,* by Hiram Powers.

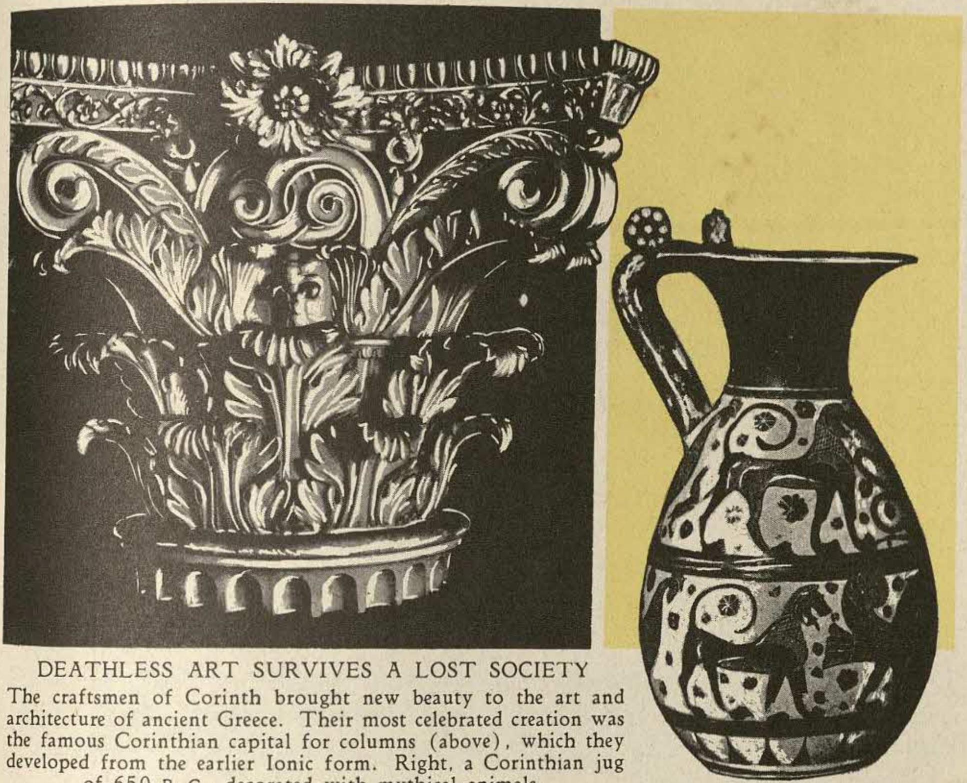
CORDILLERA, *kawr dil yah'rah,* or *kawr dil'ur ah.* From the northernmost point of Alaska to the southern tip of South America there extends a system of mountains known as the Cordilleras. The Rocky Mountains, the Sierra Nevadas, the Cascade and Coast ranges, several lower ranges in Canada and Mexico, and the towering Andes in South America are included in this group. The term is of Spanish origin and means a *string* or *cord*. Although it is sometimes used to denote any large mountain system, it generally refers to the ranges mentioned above. These are described in this work under their own titles.

COR'DITE. In order to meet the changing needs in warfare, there was adopted in England in 1887 a new explosive called cordite. It has the advantage of giving greater speed and range to shells and is smokeless. Named from its cordlike construction, it is composed of about sixty-five per cent guncotton, thirty per cent nitroglycerine, and about five per cent petroleum jelly.

Originally, cordite was composed of fifty-eight per cent nitroglycerine, thirty-seven per cent guncotton, and seven per cent petroleum jelly. This early compound proved unsatisfactory, partly because it had a high exploding temperature and partly because it had a corrosive effect on the guns in which it was used. Therefore it was changed to the present formula in 1901. Cordite burns slowly when lighted, but explodes with terrific force. It is used in small guns and cannons.

COR'INTH. In the southern part of Greece, on an isthmus connecting the Peloponnesus and the mainland, stands Corinth —in ancient times the most prosperous of the Greek cities. Although it has long since lost its former glory, it is still a place interesting to travelers.

Built centuries before the birth of Christ, Corinth became commercially important because of its two ports, one on the east and one on the west. The city also had colonies, the most important of which was Syracuse, on the island of Sicily. Corinth was conquered by the Roman consul, Mummius, in 146 B. C., and was almost completely destroyed. It was not rebuilt until the time of Julius Caesar one hundred years later. By that time it had lost much of its commer-



DEATHLESS ART SURVIVES A LOST SOCIETY

The craftsmen of Corinth brought new beauty to the art and architecture of ancient Greece. Their most celebrated creation was the famous Corinthian capital for columns (above), which they developed from the earlier Ionic form. Right, a Corinthian jug of 650 B. C., decorated with mythical animals.

cial importance, although under Caesar it had considerable prestige.

No expense was spared in making ancient Corinth a place of unequaled beauty. Overlooking the city from a plateau 2,000 feet high stood a great citadel, making the city a military stronghold. Among the most beautiful buildings was a massive temple to Apollo, seven pillars of which are still standing. Corinth was the city in which the Greeks held their Isthmian games. For a year and a half the city was the home of Saint Paul, and two of his Epistles are addressed to the Corinthians.

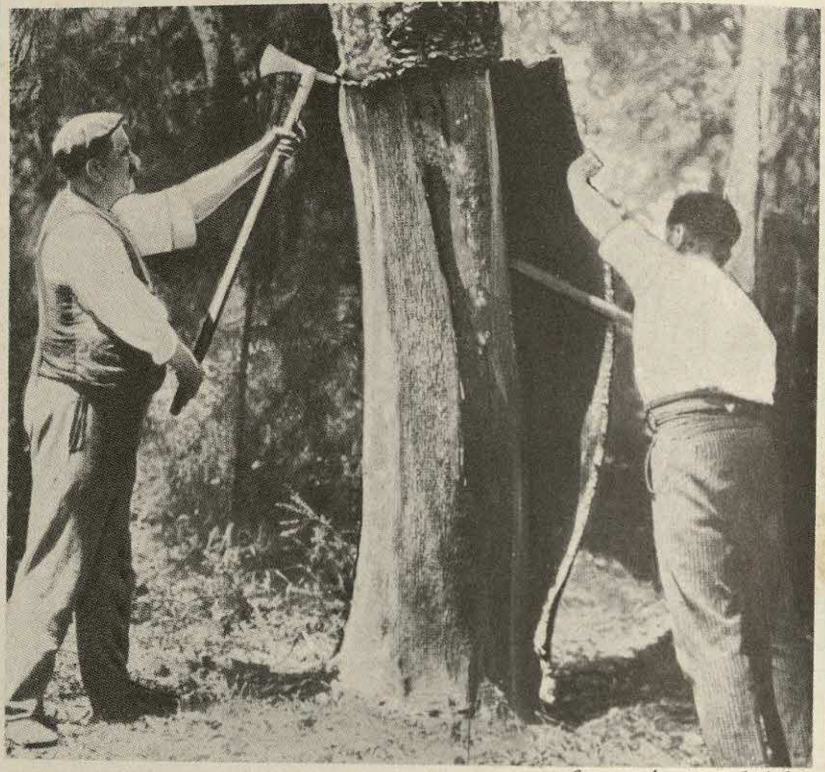
At one time, during Saint Paul's visit, Corinth was the world's wealthiest city. At that time its population numbered half a million. Today ancient Corinth is uninhabited. New Corinth, three miles northeast of the city, has a population of about 6,000. The commerce of Corinth is now unimportant, the chief attraction of the city being relics of its ancient glory.

The Gulf of Corinth. Extending across the center of Greece for a distance of eighty miles is the beautiful Gulf of Corinth. Here is one of the most beautiful spots in Europe, with an unforgettable background of lofty mountains.

The Isthmus of Corinth. Across the Isthmus of Corinth a canal four miles long was opened in 1893. It connects the Gulf of Corinth and the Saronic Gulf. At the eastern end of the canal lies the city of Isthmia; at the opposite end, Poseidonia.

CORIN'THIAN ORDER. See COLUMN.

CORINTHIANS, *ko rin'thi anz,* EPISTLE TO THE. One of the gems of the world's great literature is found in the New Testament in the Apostle Paul's *First Epistle to the Corinthians.* Chapter XIII contains his famous discourse on Christian love or charity, wherein he says: "And now abideth faith, hope, and love, these three; but the greatest of these is love." The sec-



Courtesy Armstrong Cork Co.

FROM BOTTLE STOPPERS TO LINOLEUM, CORK HAS MANY USES

It takes the cork oak nine years to grow a coat of bark thick enough for commercial use. At the end of this time the bark is carefully removed and sent to the processing mills. There it is made into one of the thousands of cork products sold.

ond Epistle urges the Corinthians to remain true to their faith and warns them of the temptations to which they are subjected.

These two letters were written about A. D. 57, the first from Ephesus and the second from Macedonia. They were occasioned by reports about dissensions in the church at Corinth and the sinfulness of its members.

CORK. One of the strangest trees to be found anywhere is the "cork oak." Its bark supplies the world with cork, that light substance so commonly used for bottle stoppers. These trees are found principally in Southern Europe and Northern Africa. Spain and Portugal are the principal sources of the world's supply of cork. The cork oak does not grow to great height, usually from twenty to forty feet, but the trunk often reaches a large diameter. The tree is evergreen, blossoms in April or May, and produces acorns which are edible.

It sheds its outer bark naturally, but cork harvested for commercial purposes is usually stripped from the tree a year or two before it would naturally shed. It is necessary to permit the tree to attain an age of about twenty years before the first harvest is made, and this first bark has little value compared with the later harvests. After the first harvest, the crop may be taken on an average of every nine years for 150 years or more.

The stripping of the bark does not injure the tree. In fact, it is claimed that it promotes its health. About forty-five pounds of cork are obtained from the average tree, although the amount may be as much as 500 pounds. It is stripped in slabs and steamed. The steaming process softens the crude bark and permits the rougher parts to be scraped off. This crude cork is shipped to a factory, where it is made up for many uses.

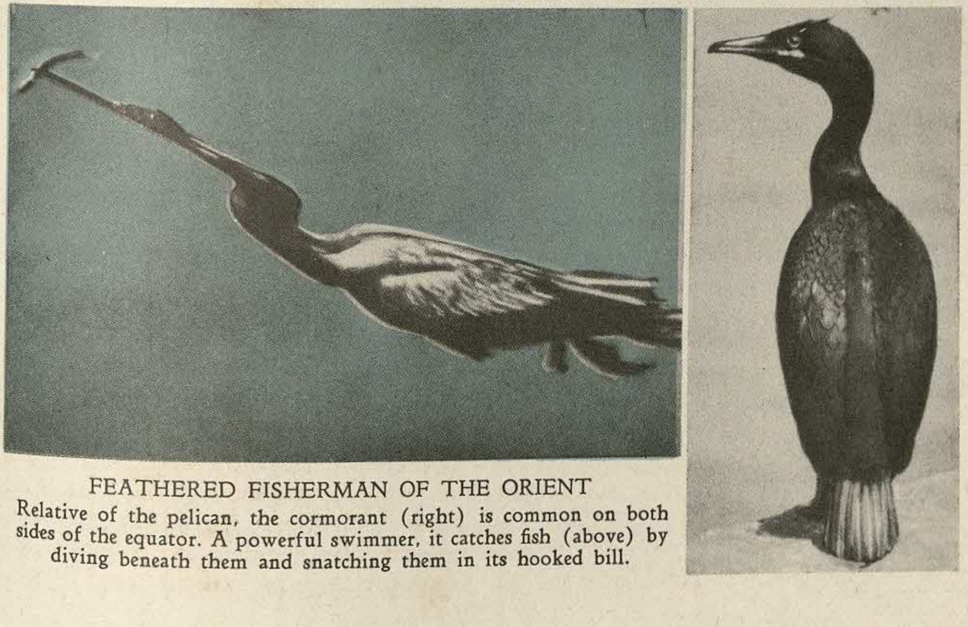
One of the principal uses of cork, due to the fact that it is impervious to air or water, is for stoppers for bottles, jugs, and containers. On account of its light weight it is often used for floats, particularly for life preservers. It is a good non-conductor of heat and is used extensively in sheet and granulated form as an insulator in the walls of cold-storage rooms or refrigerators. Ground and mixed with asphalt, it may be made into bricks for dairy-barn floors, and the basis of linoleum is cork powder mixed with linseed oil.

CORK, Ireland. With a population of over 75,000, Cork, capital of county Cork, is Ireland's second largest city. It is built at the mouth of the river Lee, occupying both banks of the river and an island between. To give the city unified communication, nine bridges have been built.

A beautiful cathedral, a free library, four monasteries, schools of art and science, University College (formerly Queen's College), beautiful parks, and fine residences combine to make Cork a city of distinction. Many signs of an ancient civilization are to be seen, for the city was founded in 622. It was later conquered by Cromwell in 1649 and by Marlborough in 1690.

Located only 137 miles southwest of Dublin, Cork is well situated so far as manufacturing and transportation are concerned. It has a large harbor of its own, as well as a fine port at near-by Cobh (Queenstown). As might be expected, Cork has a large export and import trade. Leather, glass, iron, paper, liquors, and gloves are the chief manufactures. Shipbuilding and fishing are also important.

COR'MORANT. Found in most parts of the world, the cormorants include a number of species of large, dark-colored, ducklike birds. Some species are two and a half to three feet in length. All have powerful wings, a long, rounded tail, strong, hooked bill, and feet that are fully webbed. Some eight or ten species occur in North America, mostly along the seacoasts, but sometimes on inland waters where fish are abundant; for cormorants live on fish exclusively, catching them by swimming under water with amazing swiftness and to great depths. At all seasons, the birds live in flocks. The sea species nest on cliffs, but those inland build in trees or bushes over water. Four to six greenish, chalky-coated eggs are laid. The



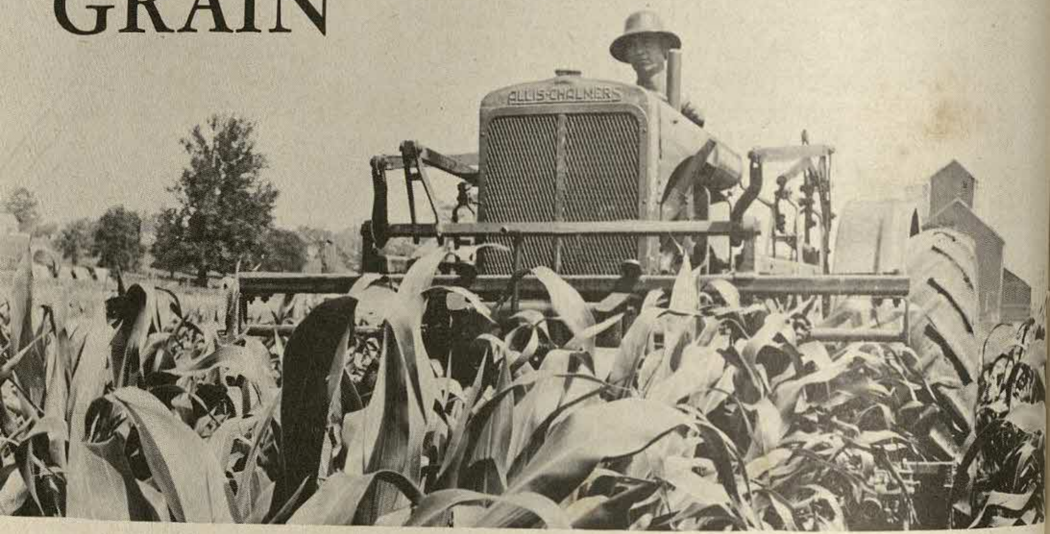
FEATHERED FISHERMAN OF THE ORIENT

Relative of the pelican, the cormorant (right) is common on both sides of the equator. A powerful swimmer, it catches fish (above) by diving beneath them and snatching them in its hooked bill.

young are sometimes considered good eating, but the flesh of the old birds has a strong, fishy flavor that renders it very unpleasant.

The skill which cormorants exhibit in fishing has long been used to advantage by the Chinese, many of whom earn a living with the aid of trained cormorants. A strap is fastened round the neck of the bird so that it cannot swallow the fish it catches. Instead, it carries them in its peculiar throat pouch until that is full, when it returns to the boat and is relieved of its booty. After it has worked enough, its owner removes the strap and lets the bird fish for itself. Fishing with cormorants is sometimes engaged in as a sport in other parts of the world.

America's GOLDEN GRAIN



U.S.D.A.

"GOLD MINING" ON THE FARM

Modern tractors are used to cultivate America's corn, the plants with the golden grain.

CORN. When the first explorers reached the New World, they found the Indians raising and living on maize, or *Indian corn,* as these Europeans called it. The white men had never seen the plant nor its fruit before; they could not foresee that, even as corn meant life and wealth to the Indians, so it would become the symbol of prosperity to a great new nation. As Whittier wrote:

> Heap high the farmer's wintry hoard!
> Heap high the golden corn!
> No richer gift has Autumn poured
> From out her lavish horn!

Corn is a native American product; and it has come to be the most valuable crop of the United States in actual dollars, as well as the leading crop in acreage. From the Americas it has spread over the entire world and now forms one of the important basic products in most temperate climates.

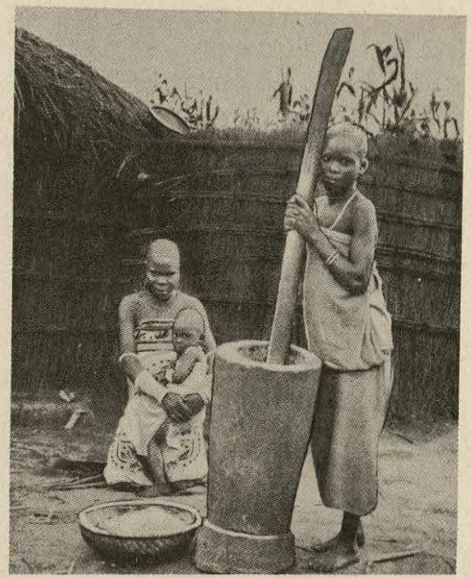
How Growing Corn Looks. Corn, a member of the grass family, closely resembles sugar cane and sorghum in appearance. It grows from four to twelve feet high, depending upon the variety. The heavy green stalks may be as much as one and one-half inches in diameter at the base, tapering toward the top. From these stalks, which are jointed in much the same manner as bamboo poles, grow long, dark-green leaves. The *ears* of corn, as the fruit is called, grow from the axils of the leaves, and may be considered branches of the main stalk. From one to four ears grow on a single stalk.

The corn plant has two flowers—the *tassel,* at the very top of the stalk, and the *silk,* fine, hairlike growths which appear at the end of the ear, each silk being a pistil leading to a kernel within the ear. Each ear is tightly wrapped in a green sheath of glumes called *husks;* the husks protect the growing ear. When the corn "tassels out," a fine dust or pollen falls from the tassels onto the silks, germinating the ear and causing it to produce the rows of kernels. Ears of corn always have an even number of rows of kernels growing around the *cob,* or thick stem.

Many Varieties of Corn. While there are dozens of varieties of corn, there are but four important types; these are *flint* corn, *dent* corn, *sweet* corn, and *popcorn.* Flint corn is raised in the cooler areas of the United States where dent corn would not mature. New York, New England, Northern Wisconsin, and Minnesota raise the greater part of this variety. It is of small size, seldom exceeding six feet in height, and the ears are long and slender, with hard, compact kernels. Its color may be either deep yellow or white.

Dent corn is the most important type. It includes dozens of different breeds. This is generally referred to as *field* corn, and is grown throughout the great Midwest Corn Belt. A giant type, it usually attains a height of ten feet, sometimes reaching fourteen feet. Dent corn is so named because of the strange shape of its kernels, each one being indented and coming to a point. Far more dent corn is produced in the United States than all other varieties combined.

Another popular type of corn is sweet corn, sweet to the taste and used as human food. It is often called *green* corn because it is picked for the table before it is fully ripe. When cooked, it may be eaten on the cob; or it may be canned for future use.



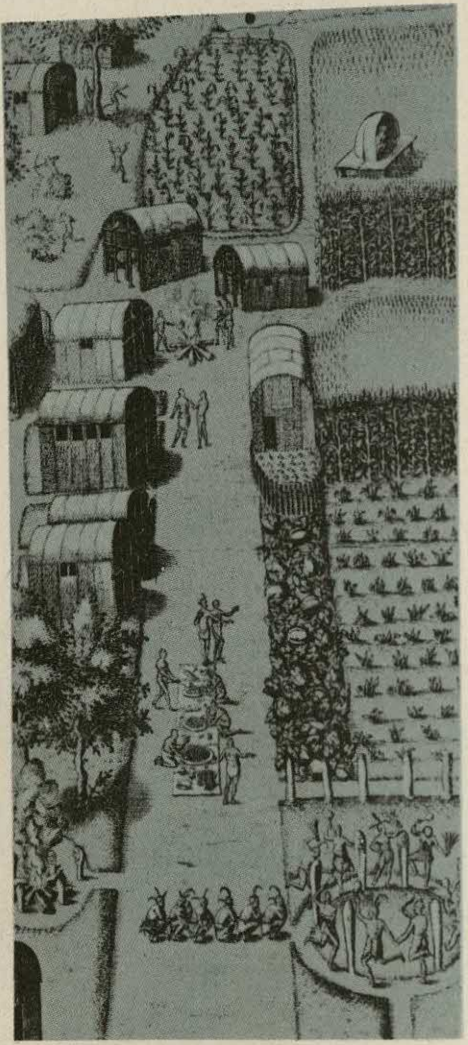
CONGO CORN GRINDER

Corn, or maize, forms a large part of the food supply of many African tribes. The crude mortar is hollowed out of a tree trunk.

Another interesting type of corn is popcorn, so-called because of the noise it makes when heated. The small, tough kernels have moisture within them which turns to steam when heated and bursts the kernel, the popped corn making a fluffy white mass several times larger than the original kernel. Seasoned with butter and salt, popcorn is a great delicacy and a popular confection the country over.

Some advance has been made in the development of a "cobless corn," many experiments having been carried on by Luther Burbank. Burbank believed that corn originally had little or no cob. By experimenting he greatly reduced the size of the cob, at the same time increasing the size of the kernels.

Weather in the Corn Belt. Because of its particular requirements, the great corn crop of the United States is raised chiefly in the Midwest. Here, hot days, accompanied by moderate rainfall, are followed by hot, stuffy nights, uncomfortable for



Courtesy Corn Industries Research Foundation

THE INDIANS GAVE US CORN

Corn was not only food, but wealth to the Indian. Good crops were occasion for feasting.

people, but ideal for raising corn. On such nights, even the faintest breath of air makes the corn leaves rustle, and people used to say of this sound, “Listen to the corn grow.” During the months of June and July in corn-growing states, field or dent corn sometimes grows several feet. The leading corn-producing states include Iowa, Illinois, Indiana, Minnesota, Nebraska, Ohio, Missouri, and Wisconsin. Thus, this group of states is often called the “Corn and Hog Belt,” because corn and livestock are the leading products.

Throughout the rest of the nation some corn is raised, but as a rule the weather is either too chilly, too dry, or too hot for an ideal crop.

Growing and Harvesting the Corn Crop. As soon as the ground is dry enough in the spring to permit the farmers to get into the field, usually late in April, spring breaking begins. Gang plows, drawn by horses or tractors, turn the ground, and later, harrows break up the larger lumps of earth. From start to finish, the corn crop is handled almost entirely by machinery.

In the Corn Belt the corn is usually planted in hills with a corn planter adjusted to drop from one to five kernels in a hill. The hills are about three and one-half feet apart each way. When corn is thus planted in checkrows, it may be cross-cultivated, thus ensuring more effective control of weeds.

Corn is also planted at intervals of from ten to thirty-six inches in rows from three to six feet apart. The wider spacings are used in dry areas and in hot, humid areas where late-maturing, heavily foliaged varieties are grown.

During the growing season, cultivations are made successively shallower so as not to destroy the fine feeder roots, which grow mainly near the surface of the ground. The corn is usually plowed about four times during its early growth in order that weeds may not choke out the young plants. Cultivation is usually finished and the corn “laid by” on or about the tenth of July.

From this time on, no attention is paid to the crop and it is allowed to ripen while the farmer attends to his other crops. Husking or “shucking” takes place late in October and November, after a heavy frost or two has dried the corn. Husking is sometimes carried on by machine, but, for the most part, men are employed to jerk the corn from the stalk and the husks from the ears. The crop is then stored in cribs for feeding stock or for delivery to elevators.

In some sections of the country, the corn is cut and shocked. A shock is a stack of corn shaped much the same as an Indian tepee. Corn for shocks is usually cut, stalk and all, while slightly green. If the fodder is allowed to dry, it loses much of its value for feeding stock. Occasionally, on dairy farms, green corn is cut and stored in silos for feeding in the winter. Most of the corn crop in the Corn Belt is "shucked" in the field, and cattle are then turned in to eat the dry stalks. During recent years, a national Corn Husking Contest has been held annually to determine the champion corn husker of America. These contests draw tremendous crowds from hundreds of miles around and, to the farmer, such an event is a sort of national holiday.

Waste and the Corn Crop. In spite of the fact that corn is the greatest crop in America, there is much waste in its production. Every year, hundreds of thousands of tons of cornstalks lie in the field and rot or are burned. Scientists in the Department of Agriculture at Washington tell us that every 100 pounds of cornstalks are capable of producing a gallon of alcohol. Thus, a single acre of cornstalks could produce over 200 gallons of alcohol, and the thousands of acres of corn land in America might produce sufficient fuel to drive our automobiles, operate our trains and boats, light our cities, and heat and light our homes.

Actually, however, the modern farmer wastes little of his corn crop. Instead, he fights to protect it against the corn borer and other pests. About 80 per cent of the American crop is consumed on the farms on which it is raised, and about 90 per cent is fed to farm animals. Thus corn plays a vitally important part in American farm economy. Since about 40 per cent of the crop is fed to hogs, there is a close relationship between the price of corn and the price of hogs.

U.S.D.A. Photo by Purdy

MAN BREEDS BETTER CORN TO MEET HIS MANY NEEDS
The man in the picture above is applying pollen from one corn plant to the silks of another. The result will be a hybrid corn, superior to corn resulting from natural pollination. Today, most of the corn grown in the American Corn Belt is from hybrid seed

International Harvester Co.; International News Photo

OUT WHERE THE TALL CORN GROWS

As the mechanical picker moves between the rows, it strips the ears from the stalks on either side (above). But the farmer enjoys picking his own supper (right).

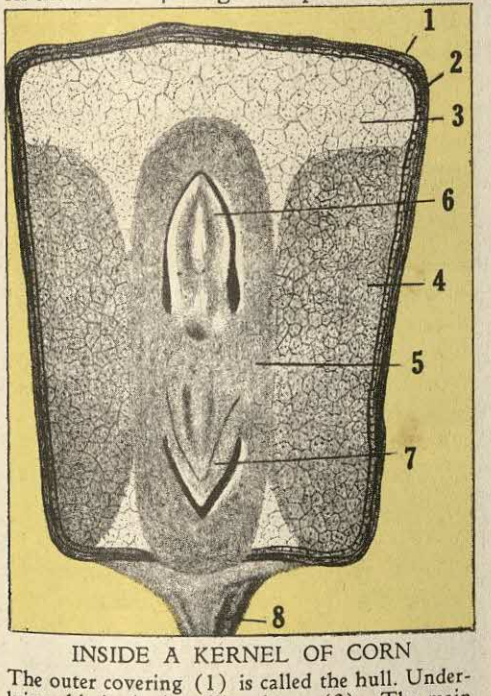
Annual Production of Corn. The annual crop of corn produced throughout the world averages between four and five billion bushels and sometimes exceeds five billion bushels. The United States usually produces from one-half to three-fifths of the world crop, and about 60 per cent of the American yield comes from the seven Corn Belt states: Iowa, Illinois, Indiana, Minnesota, Nebraska, Ohio, and Missouri. Thirty-five bushels to the acre is a good average yield, although much higher yields are common in some areas.

Argentina ranks next to the United States in corn production and is the leading exporter. Normally, China ranks third, followed by Brazil, Russia, Rumania, Yugoslavia, Italy, India, the Union of South Africa, Java, Mexico, and Egypt.

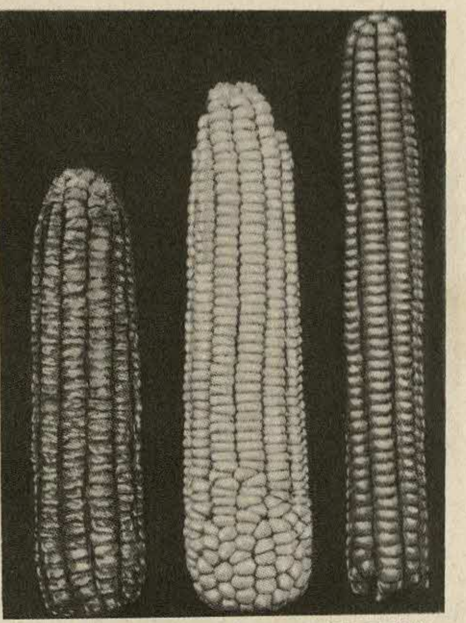
Corn Rich in Food Value. Corn ranks with wheat in food value, both being rich in starches and sugars (carbohydrates). Wheat has a definite advantage in that it is rich in gluten, necessary for making light bread, while corn is lacking in this ingredient. Corn meal is of value for making corn bread, a nutritious and palatable food, but one that is not desired as a steady diet by many people. However, during the scarcity of wheat in the first World War, people patriotically turned to corn as the basis of their daily bread.

Boys' Corn Clubs Show Progress. In the Corn Belt of America, great interest has been shown by boys of school age in growing corn. These clubs, first started in 1909 as a movement for the production of better corn, now have large memberships, and every member is expected to raise at least one acre of corn, applying the latest methods in planting, cultivation, and harvesting. He is also expected to keep an accurate account of income, expense, and profit on his project. Prizes are given for the best yield, greatest profit, quality of the crop, and written report. These projects, carried on by the boys, are supervised by teachers of agriculture, and the boys are aided by special government bulletins sent out from Washington, D. C. and from the various state universities. Surprising as it may seem, these boys often far surpass their "Dads" in production per acre, 100 bushels to the acre being a very common achievement. One boy living on a Southern farm reported a yield of 229 bushels per acre, an amazing record.

Corn Products Almost Unlimited. Scientists report that there are now over 200 different products produced from corn. One of them, already discussed, is alcohol. Paper has been produced from cornstalks, and books and even newspapers have been printed on this paper alone, although its use is not general. Dextrin, the roasted powdered starch of corn, is used for paste and sizing. It is the sticky substance used on the back of postage stamps. Cornstarch, corn oil, glucose, cereals, syrup, and flour are just a few of the more important items. Corn oil made from the germ of the kernel is used in food products, paints, soaps, tires, oilcloth, and a host of other manufactured goods. The residue after the oil is pressed out is sold as corn-oil cake for stock food. Cornstarch is utilized in confectionery, glue, ink, fireworks, shoe polish, laundry supplies, and fully half a dozen other everyday necessities.



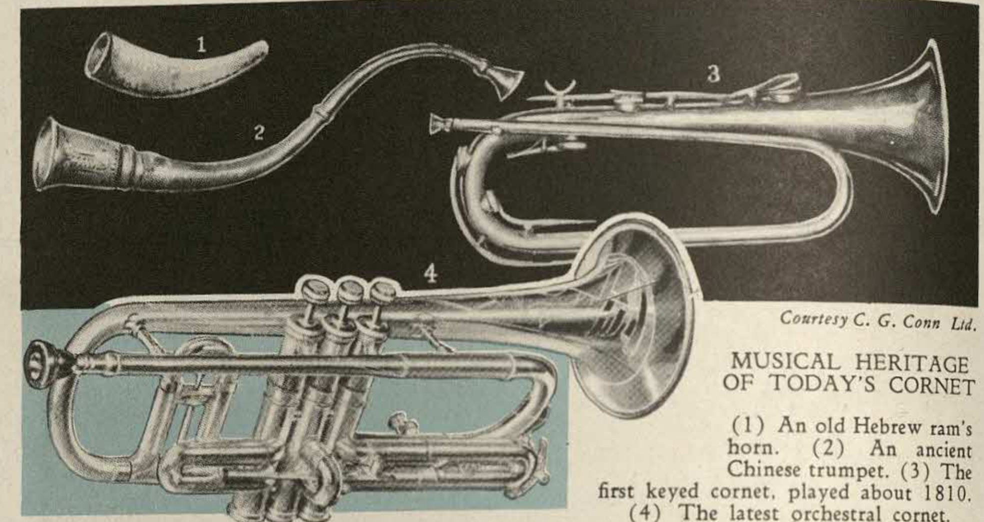
INSIDE A KERNEL OF CORN
The outer covering (1) is called the hull. Underlying this is the hornlike gluten (2). The main part of the kernel is flour starch (3) and horny starch (4). In the center is the embryo, or germ (5), the embryo stem (6), embryo root (7), and the tip cap (8).



TYPES OF NORTH AMERICAN CORN
These are three types of corn. From left to right they are sweet, flour, and flint. Others are pop, dent, and pod corn. Flint corn is grown in New England and has very hard kernels.

Even the corncob is not wasted, for from it corncob pipes are made. In rural sections, corncobs are also generally used for fuel and they can be made to yield pastes and furfural, the bran used for many synthetic resins. Corn silks are often used in medicines. All in all, it is hard to imagine a product with more uses than corn. And the 200 known products are only a beginning. With chemists busy in their laboratories, America may expect the number of corn products to increase in the course of the next few years.

CORN'EA. See Eye.



Courtesy C. G. Conn Ltd.

MUSICAL HERITAGE OF TODAY'S CORNET

(1) An old Hebrew ram's horn. (2) An ancient Chinese trumpet. (3) The first keyed cornet, played about 1810. (4) The latest orchestral cornet.

CORNET, *kor'net,* or *kor net'.* Famous bands, like those of Sousa and the United States Marine Corps, usually include accomplished soloists on the cornet. This instrument leads the brass section of most bands and orchestras. It consists of a conical brass tube four and one-half feet in length, curved so that it can be carried conveniently, and ending in a cupped mouthpiece at one end and a flaring bell at the other. The cornet is supplied with pistons (usually three) which, by opening up additional sections of tubing, lower the pitch of the instrument. The compass of the B-flat cornet is from the F sharp below middle C to two octaves above middle C, with all chromatic tones between. Players with very strong lip muscles can produce higher and lower notes.

Both a B-flat and an A cornet are used in the orchestra. The E-flat cornet is very useful in purely brass bands. With comparatively little study and after a few months of practice, it is possible to perform quite difficult sounding and showy effects on the cornet, a fact which accounts, no doubt, for the popularity of the instrument.

CORN'FLOWER. It seems strange that the pretty little *bachelor's button,* as the cornflower is generally known, should ever be regarded as a common weed. But this is the place it has in Central Europe, where it grows in such abundance that it is a nuisance in the grain fields. In the United States, the cornflower is a hardy garden plant.

Bright blue is the typical color of the blossoms, which grow on crisp, thin stems a foot or two high. Some cultivated strains produce flowers in beautiful shades of purple, pink, and lavender.

BLUE GAIETY—BACHELOR'S BUTTONS
Cornflowers, called the hardiest of annuals, grow in many an old-fashioned garden.

A NEW NATION WINS A WAR!

Lord Cornwallis, commander of the English forces during the American Revolution, surrendered his sword to Washington October 19, 1781, at Yorktown, Va.

CORNWALLIS, CHARLES, First Marquis of (1738-1805). When British General Cornwallis surrendered to the Americans and French under Washington and Rochambeau at Yorktown, Va., in 1781, the Revolutionary War was practically ended.

Cornwallis was educated at Eton and Cambridge. He entered the British army and fought in Europe during the Seven Years' War. As a member of Parliament during the days of dispute between George III and the colonies, he opposed the king's reactionary policy. In 1776, however, in line of duty he took command of seven regiments sent to America to aid General Howe, who had succeeded General Gage as commander in chief of the British army.

After the Battle of Long Island, in which he took a prominent part, Cornwallis followed Washington into New Jersey, where detachments of his army met defeat at Trenton and Princeton. In 1777 he won the Battle of Brandywine, and was rewarded with the rank of lieutenant general.

Entrusted with the British campaign in the Southern colonies, he defeated Gates at Camden, S. C., and Greene at Guilford Court House, N. C.

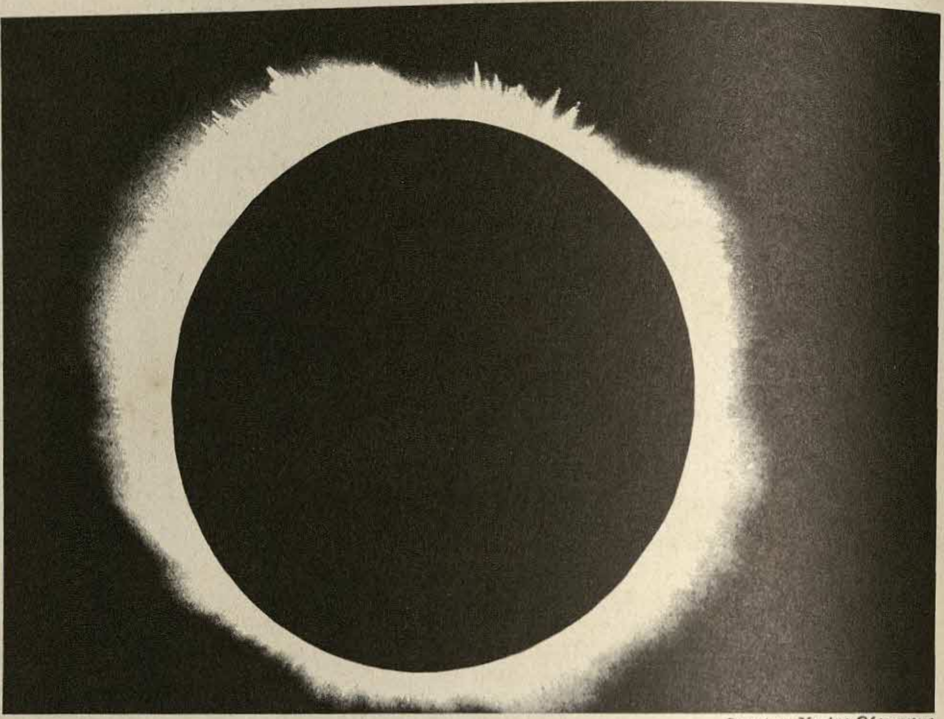
In the spring of 1781 he abandoned the half-conquered Carolinas for Virginia, which he believed to be the center of colonial resistance. After an unsuccessful campaign against Lafayette, he was besieged on the peninsula at Yorktown by Washington and Rochambeau, who were aided by a French fleet under command of De Grasse. Thus outgeneraled, Cornwallis surrendered with an army of 7,000 men.

In later years, he served his country with distinction in Ireland, and in India, where he died. See REVOLUTIONARY WAR IN AMERICA; YORKTOWN.

CORO'NA. The word *corona* comes from the Latin for *crown*. This term has a number of different meanings, but the most interesting of them pertains to the crown of light appearing around the sun during a total eclipse.

Encircling the black disc which covers the sun, the solar corona appears as a brilliant light, with feathery streaks of radiance shooting off in every direction.

The term is also used in connection with electricity. When a high-voltage current is transmitted, a faint glow of blue will be seen around the wire or conductor, show-



Courtesy Yerkes Observatory

IN ALL THE UNIVERSE NO SPECTACLE SO GRAND

The flaming glare of the solar corona surrounds the black target of the passing moon at the moment of total eclipse, forming a ring of incandescent brilliance. The phenomenon is scientifically important because it is associated with sunspot activity, which is believed by some to have a direct effect on mankind.

ing a loss of electricity. This glow is the corona of electrical-engineering terminology.

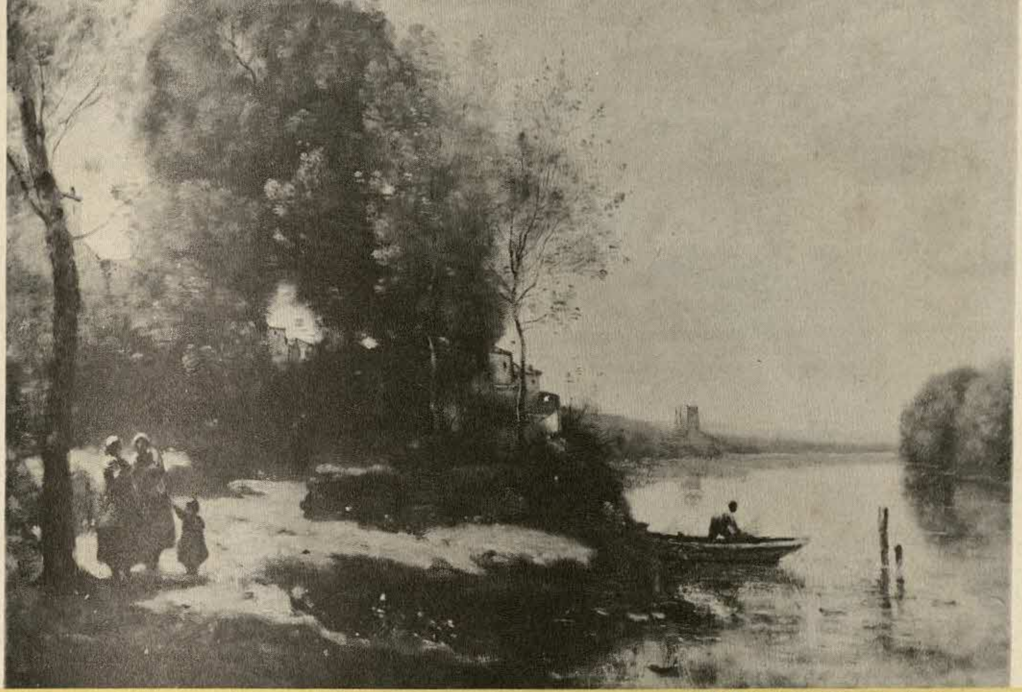
In the study of plants and flowers, a corona is a long appendage appearing between the stamens and corolla of certain flowers such as the narcissus.

As an architectural term, corona refers to the projecting portion of a classic cornice.

CORONADO, *ko ro nah'doh,* Francisco Vasquez de (about 1500-1554). A Spanish explorer of the exciting days when men were still seeking vast stores of gold in the New World, Coronado was the first white man to see the great southwestern part of the United States. He went to Mexico from Spain in 1535 and four years later was appointed governor of New Galicia, a province of Mexico.

Coronado heard stories of the great wealth to be found in some vague region to the north and west of Mexico. In fact, a monk, Fray Marcos de Niza, claimed to have seen the "seven cities of Cibola" supposed to contain the untold riches. His imagination fired by these stories, Coronado started out in 1540 to discover the riches himself. At the head of an expedition, he began his journey from the west coast of Mexico. But his high hopes were never realized. He wandered into what is now New Mexico and found only Pueblo Indian villages. Exploring parties which he sent out discovered the Grand Canyon and more Pueblo Indians, but no gold.

After spending a winter in the strange land, Coronado determined to strike east in a search for Quivira, which he thought, from what the Indians told him, might be one of the cities he was seeking. He traveled through what is now Texas and probably even into Kansas. But still he failed to



The Metropolitan Museum of Art

THROUGH COROT'S EYES

This painting, entitled "River With A Distant Tower," shows the slight haziness of line that is a distinctive characteristic of Corot's beautiful landscapes.

find riches. Finally, in 1542, he abandoned hope and returned to Mexico, the victim of a "traveler's tale."

Although he found no gold, Coronado's discoveries nevertheless broadened men's knowledge of the New World and were later the basis of Spain's claim to the southwest territory.

COROT, *ko ro',* **JEAN BAPTISTE CAMILLE** (1796-1875). The soft, blending colors of his landscapes have made Corot outstanding among French painters. His pale greens and lively grays in dawn and twilight scenes have been compared by many to the rhythm and feeling of poetry.

Corot was born in Paris, the son of a milliner. While attending the college at Rouen, he became interested in art, but without his father's favor. After finishing school, he was apprenticed to a draper. Finally, after several years, his father agreed to let him study art. He studied under Victor Bertin, and spent considerable time traveling in France and Italy.

Beloved by young and old for his gentle, kind manners, Corot lived near the forest of Fontainebleau, where many beautiful scenes caught his eye at dusk. Corot's first paintings are rather mechanical in form and arrangement, but with each succeeding picture there is an increasing interest in fine color tone.

Among his best-known landscapes are *The Lake* and *The Dance of the Nymphs.* He also gained distinction for a number of figure paintings, particularly of a religious nature. *Flight Into Egypt* and *Baptism of Christ* are the best known. The best American collections of Corot's work are in the Metropolitan Museum in New York and the Chicago Art Institute.

Corot is classed as a member of the Barbizon School of French painting, composed of painters who lived in the Barbizon region near Fontainebleau. They believed that paintings should be made directly from nature and should express the artist's individual feeling toward an object or scene.

COR'PORAL. See RANK.

CORPORAL PUN'ISHMENT. Popularly restricted in meaning to the chastisement of children for misconduct, this term has in law a broader application. It means punishment applied to the body of an offender, and may refer to whipping in private or in public, imprisonment, or even to the application of the death penalty.

In its common meaning, corporal punishment is losing ground among people of enlightenment. As a means of discipline of children it is acknowledged that the effect is injurious—not necessarily in a physical sense, but morally. The child resents physical force and submits only because he feels that he must. Bodily pain, too frequently inflicted, coarsens the nature and makes a child indifferent to efforts at correction.

Volumes have been written on the subject; the conclusions reached seem to suggest that enforced obedience is not real training; punishment that inflicts pain causes bitter feelings, and true discipline is built up only through willingness and freedom of action resulting from precept and example.

CORPORA'TIONS. This is the usual name applied to companies organized to carry on some particular kind of business. They usually have not one or two owners, but many, sometimes numbering several thousands. Ownership of the company is split into "shares," and each owner is given a document showing how many of these shares he has paid for and owns. Consequently, he is known as a shareholder or stockholder.

Most of these stockholders are small investors who usually are employed at some work of their own. So they annually vote to elect a board of directors, who really direct the company. These directors likewise elect from their number the officers of the company. The officers usually include a president, one or more vice-presidents, a secretary, and treasurer. It is this group of men who actually supervise the operation of the business.

History of Corporations. Just when corporations originated, no one knows. They were common in ancient Rome, and were used in conducting business by the Normans in England. In their present form, however, corporations were first known in Europe in the sixteenth and seventeenth centuries. One of the most important types of corporations of that time were those organized to develop and explore new lands. The first of these was the Dutch East India Company, organized in 1602.

In the United States, corporations came into general use early in the nineteenth century, and were chartered by the states to carry on business. One of the first corporations in America was the First Bank of the United States, chartered by the Federal government in 1791. Since that time, corporations have grown very rapidly and are now found in every state. They are found in greatest number, naturally, in those states which have laws most favorable to their organization and operation.

Advantages of Corporations. An outstanding advantage of corporations is the fact that they are permanent. If a shareholder dies, his stock goes to some other person and the business continues. Members of a corporation also have limited liability; that is, they can lose only what they have invested in stock, in case the business fails.

Another advantage is the fact that stockholders are not liable for the acts of other shareholders. In a partnership, however, one partner is responsible for all the debts of another, in case the debtor is unable to pay.

Corporations and the Public. The corporation has been a great benefit to the consuming public. Mass production, with its resulting lower cost to the consumer, was brought about by this method of business. Huge taxes for the support of the government are annually paid by corporations, and thousands of jobs have been created for workers. Moreover, corporation stocks and bonds are often good investments for the man who wants to save money. Opposed to these advantages is the possibility of a corporation's becoming monopolistic, whereby it may control the market of some product and force the public to pay high prices.

Types of Corporations. Public corporations are those created for governmental purposes, such as cities, villages, and other administrative divisions.

Private corporations may be classified as follows:

(1) Corporations for profit, such as railroads and telegraph and telephone companies.

(2) Corporations not for profit, such as social, religious, or scientific clubs.

(3) Corporations for mutual aid, such as lodges and building-and-loan societies.

(4) Incorporated trusts, which are corporations having charge of money to be used for educational, charitable, or other specified purposes.

CORSICA, *kawr'si kah.* A hundred miles southeast of France lies beautiful Corsica, the mountainous island birthplace of Napoleon Bonaparte. About 110 miles long, north and south, and about half as wide, this ancient French-governed country of the *vendetta* is the fourth largest island in the Mediterranean Sea. It is a steppingstone from France eastward to Italy and south to the island of Sardinia.

The granite block that is Corsica reaches its greatest heights in Mount Cinto, 8,891 feet above sea level, and in Mount Rotondo, 8,610 feet. Along the eastern and southern coasts are narrow but rich plains, and in the interior are many fertile valleys. Here agriculture, the island's principal industry, is carried on. The steep mountain slopes, famed for magnificent scenery, are clothed with lush forests of oak, pine, beech, and chestnut.

Out of these resources and the riches of the surrounding sea grows Corsica's normal export trade in wines, olive oil, chestnuts, fruit, fish, and forest products, including cork. The island has many excellent harbors. Ajaccio, the capital, on the west coast, is connected by railway with the interior and the cities of the north, including Bastia, the principal commercial town.

Ajaccio is a quaint city, with a population of about 23,000. Its greatest tourist shrine is the house of the Bonaparte family, the humble dwelling which saw the birth of the "Little Corporal" who became an emperor and died an exile.

Cyrnos was the name given to the island by the Phoenicians, who were the first to settle on its western shores. When the Romans took possession, they changed the name to Corsica. (The ancient name, in Corsican dialect, is from the Greek, *Kalliste* —"most beautiful"). After the Romans came the Goths, then the Saracens, and, finally, the Genoese. The island became a possession of France in 1796 and is now governed by that country, but the people are of Italian stock. The area is 3,367 square miles; the population is about 325,000.

CORTEZ', HERNANDO (1485-1547). In the year that Columbus discovered America, there lived in Medellin, Spain, a seven-year-old boy who was destined to follow that famous sailor across the Atlantic, to conquer Mexico, and to begin the ruin of the great Aztec civilization. The Spanish boy who became the soldier of fortune, conquistador, and treasure hunter was Hernando Cortez.

Always an adventurous youth, Cortez set sail for the West Indies at the age of nineteen. Scarcely had he arrived in Santo Domingo when he attained distinction by putting down a revolt of the natives. In 1511 he was made a chief lieutenant of Velasquez in the conquest of Cuba.

In 1518 Cortez was sent by Velasquez, then governor of Cuba, on an expedition to Mexico. Shortly afterward, Velasquez made an effort to recall the expedition, but Cortez sailed on with about 700 Spaniards, eighteen horses, and ten small guns. He anchored his fleet in the Gulf of Mexico, later burning all his ships to make sure his soldiers would not desert him. In several bitter fights the Spaniards defeated the tribes on the coast, then proceeded toward the capital of the Aztecs, on the site of the

THE AZTECS SUCCUMB TO SPANISH SWORDS

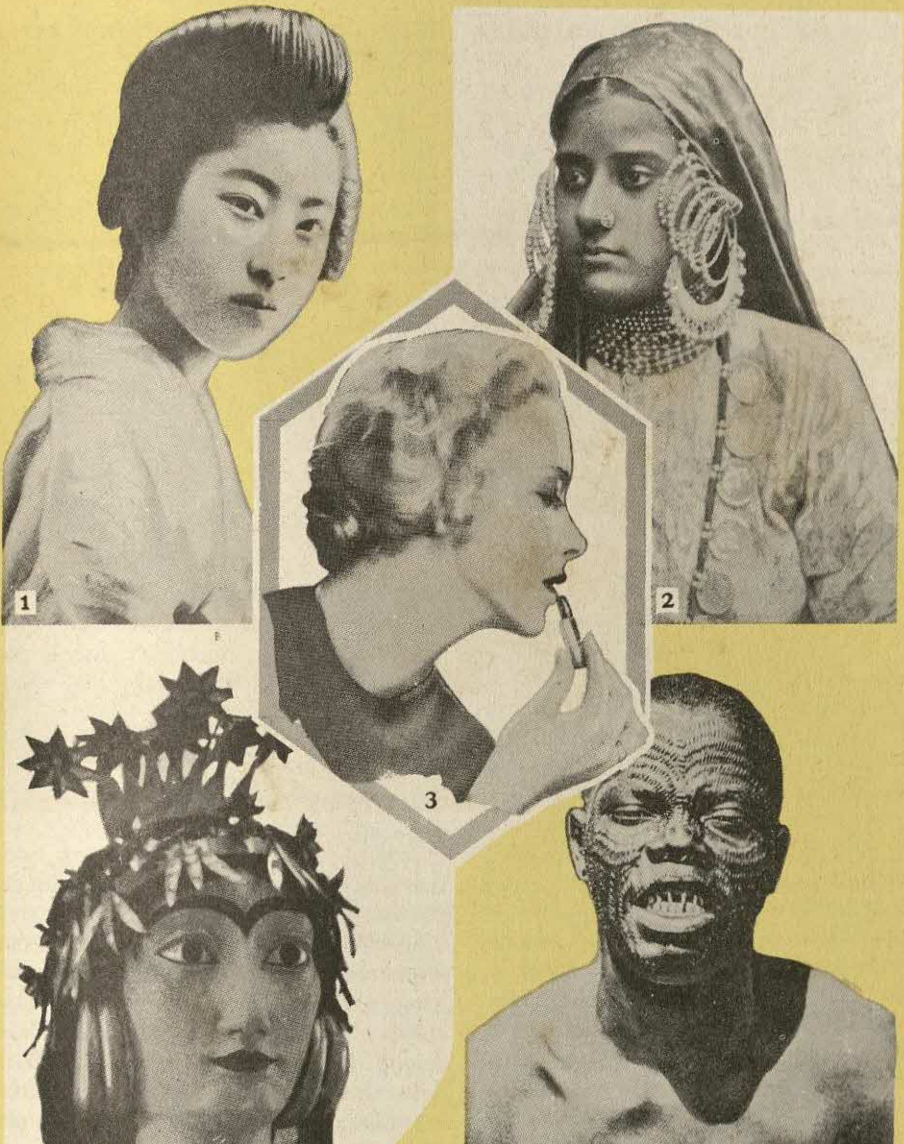
Hernando Cortez, greatest of Spain's conquistadors in the New World, was the first to invade the territory of the Aztecs. With his arrival the halls of Montezuma echoed to the ring of Spanish steel, and the glory of the Aztec Empire faded forever from the Americas.

present Mexico City, the capital of Mexico.

Arriving there, Cortez was greatly surprised to meet no resistance. On the contrary, Montezuma, chieftain of the Aztecs, received him hospitably and entertained him. When, however, Cortez learned of a plot against his life, he captured Montezuma and held him as hostage. While a captive, Montezuma died, and the furious Aztecs drove the Spaniards from the city, leaving behind many dead and wounded. Not until 1521 did Cortez regain the city, and then only after a bitter struggle. In 1528 he returned to Spain, but after two years he went back to Mexico, remaining there as its ruler for ten years. In 1540 Cortez returned to his native land for the last time, where he died in 1547. See AZTEC; MONTEZUMA.

COSMETICS, *koz met'iks.* The next time you meet a lovely lady on the street, pause and reflect that in making herself beautiful, she and millions of others annually spend many millions of dollars for cosmetics in the United States alone. Cosmetics are the creams, pastes, lotions, tonics, dyes, and powders used to beautify or to restore a youthful appearance.

Cosmetics are often thought to be a development of the twentieth century. On the contrary, many toilet articles have been uncovered that were buried with ancient Egyptians as early as 5000 B. C. Fragrant oils and henna for coloring the hands and soles of the feet, as well as the nails, were, and still are, great favorites among Egyptian women. Evidence has also been found that eye paint was used at an early date.



THE QUEST FOR BEAUTY NEVER ENDS

People differ on what they think is beautiful. The modern American idea of good make-up is to emphasize only good points. (1) A Japanese girl's elaborate coiffure is held in place with grease. (2) A Burmese woman of high rank. (3) A twentieth-century American girl. (4) Asiatic queen of 3500 B.C. (5) "Decorative" tattoo scars and filed teeth of a South African man.

Mud baths were also an ancient beautifying device.

The early Romans made little use of cosmetics until the time of Néro. This vain emperor used a crude sort of "make-up" including rouge, powder, and pumice stone, the latter for whitening the teeth.

Many interesting tales are told of the ladies in England, who used various strong perfumes imported from the East. In the time of Elizabeth, it was customary for ladies to wash their faces in hot water and then to bathe them in wine, to impart a healthy, ruddy glow. Many of them later adopted the practice of bathing in wine, and some even bathed in milk. As late as 1879, a bill was introduced into Parliament which specified that if any woman "tricked" a man into marrying her by the use of artificial means, such as paints, washes, high heels, false hair, or any other such equipment, her marriage would be considered null and void.

From England the use of such beautifiers spread to France, Spain, and Austria. France is now recognized as the cosmetic center of Europe; many of the finest toiletries are made by French manufacturers.

Among primitive tribes, such as the early American Indians and the African tribes of today, painting the body in fierce, bright colors was a common practice, and was supposed to lend great personal charm or power in battle to the person so adorned.

Many physicians insist that the proper amount of sleep, good food, and healthful exercise will produce a complexion unrivaled by anything coming from a cosmetic box. Be that as it may, a moderate use of cosmetics is generally not harmful, and if they are applied with discretion, the results may be very pleasing. However, it is important to use preparations of standard companies, which are known to be of pure materials and harmless. The Federal Pure Food and Drug Act is designed to protect those who buy and use cosmetics.

COS'MIC RAYS. Every minute this world of ours is being bombarded by millions and millions of tiny particles. You are never aware of them. They are the invisible cosmic rays.

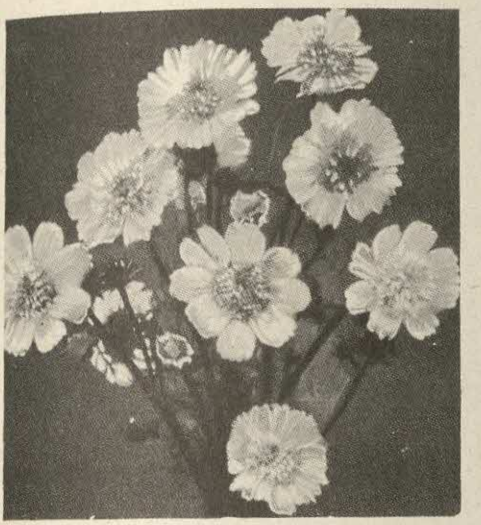
Scientists know there are cosmic rays because of the effects they produce on very sensitive recording apparatus. The word *cosmic* relates to the universe; it signifies something universal. These rays come from the seemingly limitless universe of which our planet earth is but a very tiny part.

For over thirty years, scientists have been investigating these rays, trying to find out just what they are. They have made expeditions to all parts of the earth, exploring the cosmic rays. There is still much to be discovered, but the evidence so far seems to support the theory that the primary cosmic rays that enter the atmosphere are not true rays but particles of matter: the nuclei of atoms. These primaries have such enormously great velocities that they shatter many nuclei in the atmosphere. Fragments of a disrupted nucleus are the highly energetic secondary cosmic rays that shatter still other nuclei, producing tertiaries, and so on, until the particles have too little energy to break up a nucleus. Among the particles are protons, neutrons, and mesons.

Experimental evidence leads one to believe that the rays come from outside the galaxy, or star group, of which the earth is a part. Their origin is perhaps even more remote than the most distant stars seen through telescopes.

There are a number of opinions concerning the source of cosmic rays. There is the theory that the rays resulted from an explosion that took place millions, perhaps billions, of years ago, which shook the entire universe. The enormous energy of the rays is not easily explained in any other manner. The "primeval explosion theory" of the origin of the rays was first advanced by the Belgian physicist, Lemaitre, who believed that the present system of galaxies developed out of an explosion of the primeval concentration of matter that had perhaps existed for an indefinitely long time.

Dr. Millikan has advanced the view that



IMPORTED BEAUTY

The cosmos is a native flower of Mexico widely cultivated in the United States. This early-flowering cosmos is one of many species.

the rays are being produced constantly during the formation of atoms in space out beyond the earth. He has presented evidence that this may be one stage of a process through which the universe is continually passing. On the other hand, Sir James Jeans, renowned British scientist, suggests that the rays result from destruction of matter rather than from its transformation.

The true force of these rays may be appreciated when it is realized that they are capable of penetrating as much as 1,400 feet of solid rock, equal to 200 feet of lead in density. Gamma rays, the most powerful known radioactive rays, can penetrate only one foot of lead. See PHYSICS; RADIOACTIVITY: STRATOSPHERE.

COSMOS, *koz'mos.* High above the heads of the other garden flowers, the cosmos rears itself. It does not seem so impatient to come into bloom as some other annuals, but waits until it has made its growth before using its energy in producing its flowers, which appear in autumn. One can hardly imagine a garden of annuals without cosmos. It is an excellent cut flower because of its long, strong stems and its lasting flowers, which are delicate pink, white, and brilliant rose in color. In some of the states, the cosmos has almost become wild.

Seed of cosmos may be sown directly in the open ground, but to get the later sorts to bloom earlier, the seeds should be sown in a sunny window. When the plants are up four or five inches, pinch them back to make them branch. In the garden the plants should stand eighteen inches apart; they will need stakes if they grow too tall.

COS'SACKS. The finest horsemen in Europe, the Cossacks wrote a blazing story of blood and bravery when the czars ruled over the great Russian Empire. They were known as the "soldiers of the Czar," and rare were the men who dared to stand against such a formidable cavalry.

The old life of the Cossacks resembled in several ways the unswerving devotion to endurance and skill in war we find in the annals of ancient Sparta. Children of the Cossacks were trained at an early age in the use of the sword and the whip. They were taught to ride horses almost before they could walk. During their youth they were tested for their skill and endurance by hunting their own food and competing in mock battles. When they went to war, or indulged in a plundering expedition in Poland or Turkey, they formed a hardened and fearless band of warriors.

Where the Cossacks came from is not known, but it is supposed they originated on the banks of the Dnieper and Don rivers through the association of Russians with adventure-loving people of nomad tribes. Formerly, the old men and women tended the herds of cattle which they raised on the fertile, grassy steppes of the Ukraine. The youthful and strong Cossacks congregated in camps, ready for any venture that required skill and daring. In these camps, they shaved their heads, and wore brilliant clothes taken in their plunders. Their full, wide trousers, tucked into knee-length boots, have become well known throughout the world. For recreation, they went to the small towns near by, indulged in feasting

CZARIST RUSSIA'S HARDY HORSEMEN REPULSED

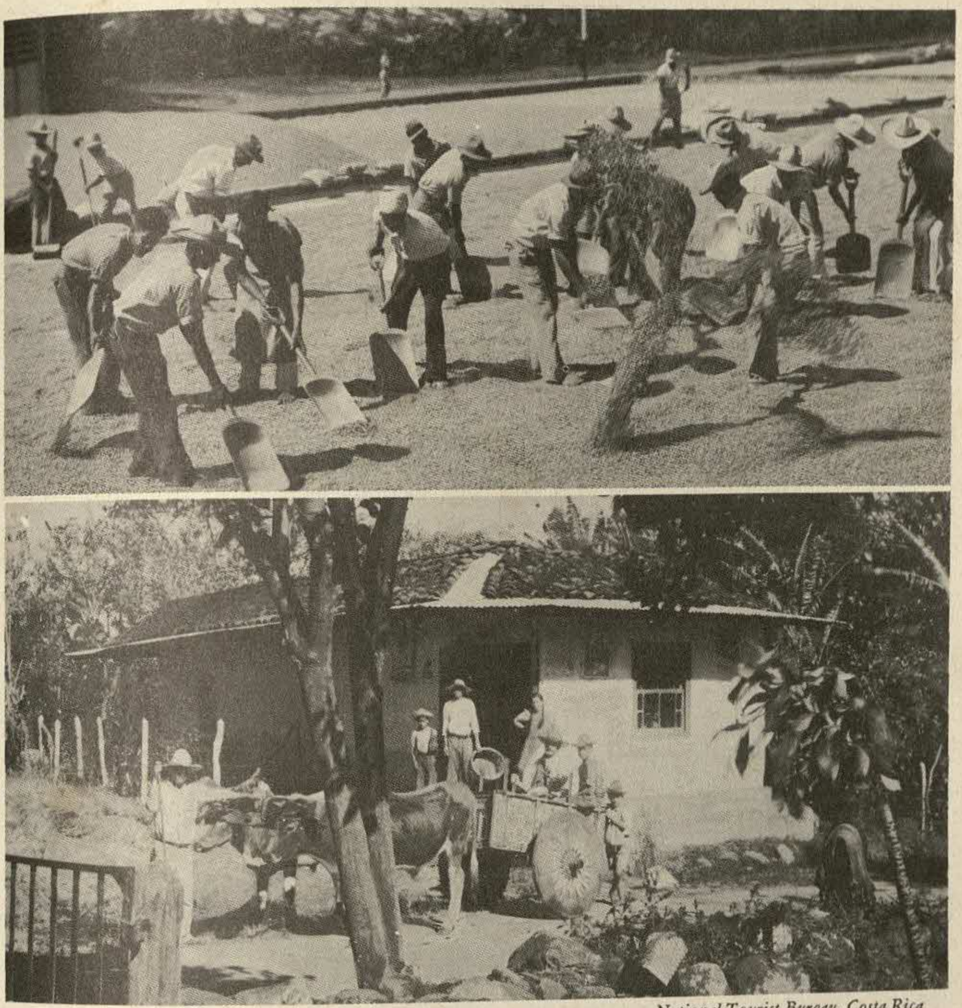
Associated with the days of brutal tyranny in the Russian Empire, the hard-riding Cossacks proved inefficient against well-organized forces during the Russo-Japanese War. The Cossacks' chief duty was the suppression of revolts among Imperial Russia's starving lower classes.

and drinking, and frequently engaged in duels and fights for the sheer love of such activities.

Because the Cossacks were the czars' favorites, and because they were an independent people whom the rulers of Russia could not afford to oppose, they received many privileges. They paid no taxes on their land and maintained their own democratic government with a "hetman" or chieftain at the head of each tribe. In return, all Cossacks between the ages of eighteen and thirty-eight were subject to military discipline. Because their status was so different from the impoverished serfs who were taxed heavily and had little voice in the government, the Cossacks naturally were disliked by the people. Their habit of plundering also won them enemies among the other Russians.

Cossack music and dancing have spread around the world. The usual musical instrument was the guitar, and at night, around a campfire, the Cossack soldiers would revel in their vigorous, lively dances to the accompaniment of guitars and clapping hands. Feats of Cossack horsemanship seldom seen anywhere else in the world were always special treats at any great Russian fair or celebration.

Today, the colorful life of the Cossacks has largely disappeared. No longer members of a privileged class in Russia, they work in the wheat fields and grazing grounds of the Ukraine. But, in World War II, when the Germans invaded the Soviet in 1941, the Cossacks again fought fiercely in many engagements, renewing



National Tourist Bureau, Costa Rica

SUN-FILLED SCENES IN COSTA RICA

Their shovels shining in the warm sunlight, Costa Rican workers spread coffee beans to dry (top). Farmers add to the sparkle of their colorful country by covering their sturdy oxcarts with gay decorations. Broad-brimmed hats shade the eyes of young and old (bottom).

the old fear of the cry "The Cossacks are coming!" and aiding greatly in turning the tide of the German advance.

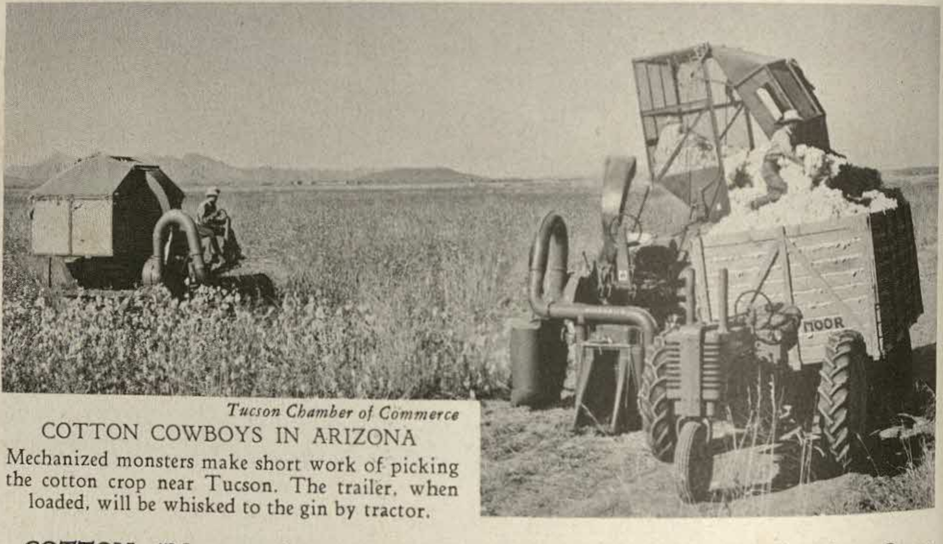
COSTA RICA, *ko′sta re′ka*. Far south in Central America, separated from South America only by Panama, is the Republic of Costa Rica, the "rich coast." About the size of West Virginia, it has an area of about 23,000 square miles and an estimated population of about 1,000,000. The language of the country is Spanish, the religion Roman Catholic. However, religious liberty is available to all under its Constitution.

Columbus first discovered the Costa Rican shore in 1502, although it was not settled by the Spaniards until 1532. In the period from 1570 to 1821 it was a province of the Central American "Captaincy-General of Guatemala." In 1821 Costa Rica and the other Central American countries declared their independence. For a brief period Costa Rica was a part of Mexico. Prior to 1848, several unsuccessful attempts were made to combine Costa Rica and other Central American countries in a Central American Federation.

Government is administered by a President, and legislative powers are vested in the Legislative Assembly, a chamber of forty-five Deputies. The Deputies are also elected for four-year terms. The capital of Costa Rica is the city of San José, the largest city in the country. It has a population of about 153,000.

A narrow country, traversed by lofty mountains throughout its length, Costa Rica is a land of widely different climates. Along the seacoast the air is hot and damp, the vegetation tropical; on the slopes from 3,000 to 7,000 feet, temperate conditions prevail, and above 7,000 feet it is decidedly cool. The climate, in the main, is healthful.

Naturally, under such conditions as prevail here, agriculture is the leading occupation. Costa Rican coffee is very highly regarded. Other leading crops are cacao products, sugar cane, corn, potatoes, rice, tobacco, bananas, and Manila hemp. The development of transportation and communication has been a great aid to manufacture and commerce; there are about 500 miles of railway and some 350 miles of roads for automobile traffic. In Costa Rica the manufacturing establishments are principally engaged in converting the country's agricultural products into finished goods. The liquor distilleries are all under government regulation and control.



Tucson Chamber of Commerce

COTTON COWBOYS IN ARIZONA

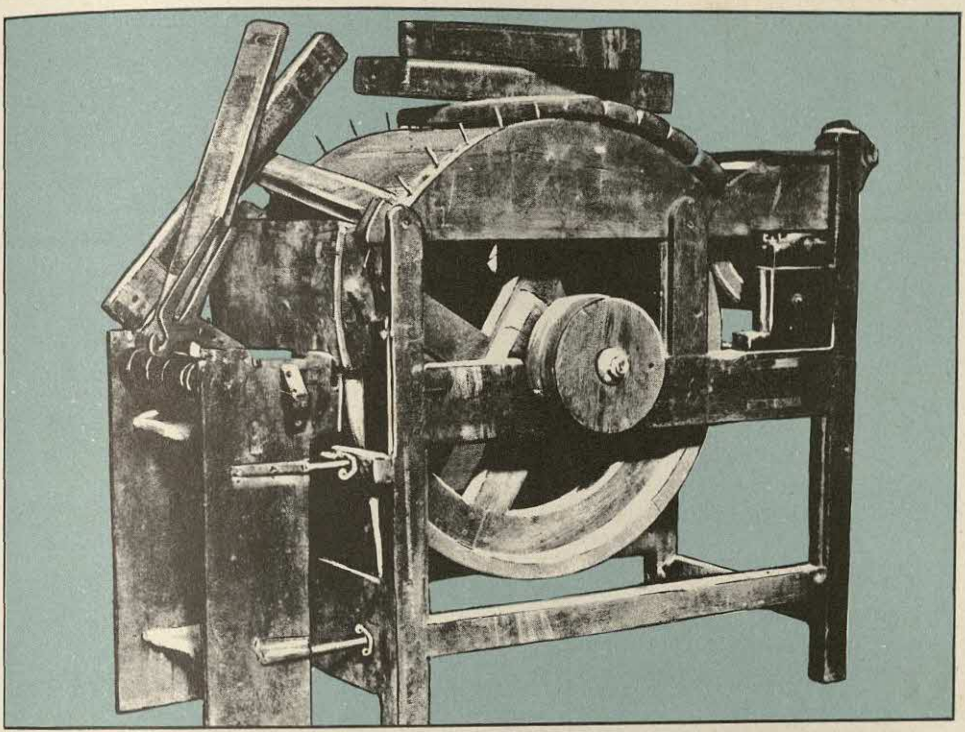
Mechanized monsters make short work of picking the cotton crop near Tucson. The trailer, when loaded, will be whisked to the gin by tractor.

COTTON. "No, you dare not make war on cotton. No power on earth dares to make war upon it. Cotton is king!" thundered Senator Hammond before the United States Senate on March 4, 1858.

Cotton is indeed king among the plant fibers. In acreage planted, it is exceeded only by wheat, rice, corn, barley, and oats. Despite the invention of numerous synthetic fibers, such as nylon and orlon, cotton cloth is still the world's most important basic wearing apparel except in the polar regions. It has even acquired many of the easy-care features of the synthetics.

History of Cotton Production. Cotton is not only one of the world's most important crops, but one of its oldest. It is believed that cotton was used for clothing at the dawn of history and probably originated in Asia. We do know that it was an important crop in Egypt by 1000 B. C. Somewhat later it became known to the Greeks and Romans. The manufacture of cotton cloth was introduced into Europe by the Moors when they invaded Spain in the Middle Ages.

When America was discovered, explorers found the natives of Mexico, Peru, and the



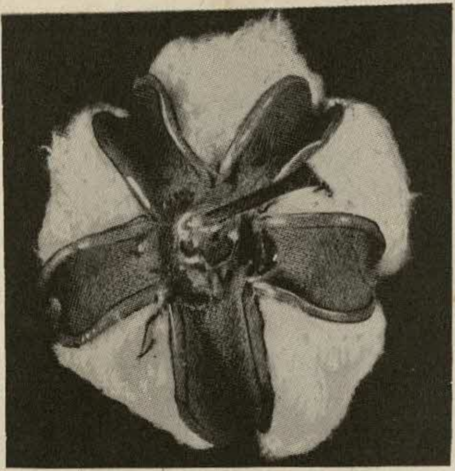
UNTANGLING NATURE'S "THREADS"

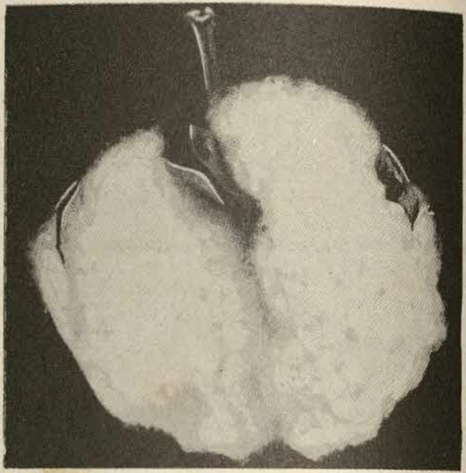
One of the earliest problems of cotton production was the removal of snags and impurities from the bolls. In 1790 Samuel Slater built this machine to "comb out" the cotton, or *card* it. Driven by water power, the revolving drum and its spikes partially straightened the knotted skeins.

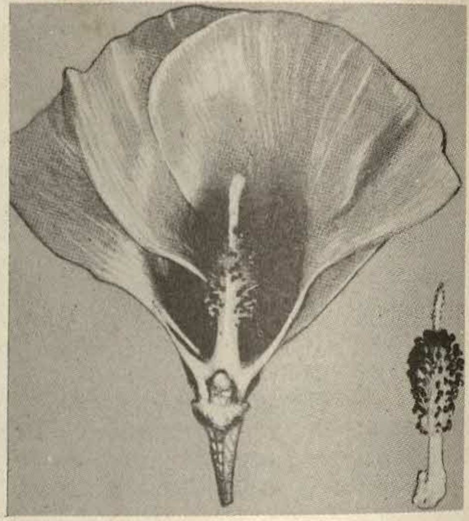
West Indies raising cotton. Some cotton was raised by the early colonists in the South, but it was not commercially valuable until the end of the eighteenth century. In 1786 some cotton seeds were sent from the Bahamas to a Mr. Levett who owned a big plantation on an island off the coast of Georgia. He thought so little of them that he threw them outdoors, where they took root and grew. Out of curiosity, he transplanted the young plants and raised a small crop. Samples were sent to England and pronounced very good, and planters in the South immediately began to raise crops of cotton. But there was no purpose in raising more cotton than they could clean, for it took a man a full day to remove the seeds from a single pound.

During the eighteenth century, two inventions in England were destined to change the history of the United States. These inventions, the power loom and the mule jenny, so speeded up cotton-fabric production that the English mills began to demand more and more raw cotton. Then, in 1793, Eli Whitney, an ingenious Yankee schoolteacher who was visiting in the South, invented the cotton gin. This machine, operated by one man, could clean more cotton in a day than a hundred men could clean by hand. So eager were the planters to secure the machine that some of them broke into Whitney's shop one night and carried it away.

The effect of the cotton gin was immediate and far-reaching, for the planters began to raise more cotton to buy more land to bring in more slaves to farm still more cotton. These slaves, sold to the planters by traders who captured the unfortunate Africans, led to the bitter war between the North and the South. At the







FROM THIS FLUFFY BALL—CLOTH
Cotton bolls are seed pods full blown. (1) The underside of the boll. (2) The top. (3) The flower of the cotton plant at an earlier stage, with the seed stalk inside, shown enlarged.

beginning of the Civil War the cotton plantations extended from Virginia westward through Tennessee as far as Texas and Arkansas.

In 1791 the United States furnished the English with less than one-sixth of one per cent of their raw cotton. One hundred years later, the United States supplied sixty per cent of the world's crop. This meant an increase from 8,899 bales of 225 pounds each to 9,534,700 bales of 500 pounds each.

Varieties of Cotton. Of the many varieties of cotton raised, there are but four figuring prominently in world trade.

One is *sea-island* cotton, so-named because it was originally raised on the low, coastal plains of South Carolina, Georgia, and Florida and on the adjacent islands. It is of the finest quality, with long, silky fibers averaging 1.61 inches in length. The plant often attains a growing height of twelve feet or more.

Egyptian cotton is merely another variety of sea-island, imported into the United States because of its cheapness. It is used in the manufacture of goods which require a smooth finish. For many years it was used almost exclusively in the manufacture of automobile tires. Recently, however, because of its scarcity, the tire industry has turned to Peruvian cotton. Limited quantities of Egyptian cotton are raised in Arizona and in the Imperial Valley in California.

Peruvian cotton, another imported variety now cultivated in California and Arizona, has a rough, strong fiber which mixes readily with wool. Although used extensively in the manufacture of underwear and hosiery, the greater part of this crop goes into the manufacture of tires.

Ninety-nine per cent of the American cotton crop is the *upland* variety. The plant grows from two to four feet high and produces fibers less than an inch in length. It is the variety grown throughout

Frisco Lines

WILL IT MAKE THE GRADE?

Cleanliness is part of the grading of cotton. The cotton gin separates the fibers from the cottonseeds, leaves, and sections of the boll that might cling to it.

the South from the Atlantic coast to Texas. It is used in making all cotton products, including cellulose.

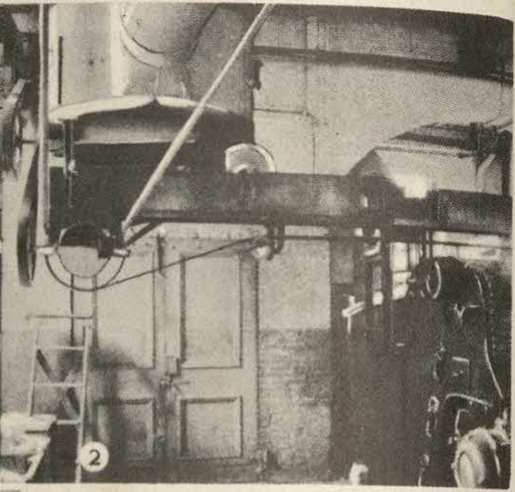
Two other varieties, *Indian* and *Bengal* cotton, are raised in India and Pakistan and elsewhere in the Orient.

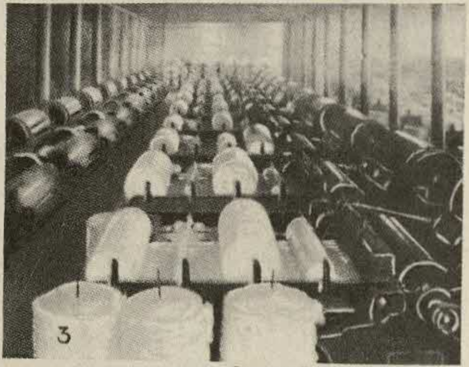
Planting the Cotton. The most important item in the raising of cotton is a well-prepared seedbed. Plowing should be done in the fall, so that winter rains and snows can sink into the ground; spring plowing dries out the ground too rapidly. Fall plowing also gives fertilizers time to be fully absorbed. In the spring, the land is harrowed to break up chunks of earth, after which the cotton is planted in small ridges from four to five feet apart. This ridging causes the ground to warm up faster and drain better.

Planting begins about two weeks after the last killing frost, usually in April or May, depending upon the part of the country in which the cotton is planted. Somewhat more than a bushel of seed is planted to the acre. It is drilled into the ground by machine, and later is chopped to be thinned out to a stand. The seed is usually planted very close to the surface to promote quick growth and make full use of rainfall.

How Cotton Is Cultivated. As soon as the cotton crop is well above the ground, plowing with cultivators begins, in much the same manner as corn is tended. This work must be carefully done to avoid covering up the tiny plants with earth. Following this cultivation, the cotton is chopped, or thinned, with hoes, leaving one plant to about every eighteen inches. After the chopping, the fields are again cultivated, and the earth is thrown up around the stems of the young plants. Usually, cotton is cultivated about five times, at intervals of two weeks, to keep down the growth of weeds.

During this growing stage, the planter must be alert for signs of insect pests in the cotton fields. The three most destructive pests are the cotton-boll weevil, the cotton bollworm, and the cotton leafworm. These pests are controlled by dusting an arsenate over the plants. The cotton leafworm has been known to strip a field of leaves completely in five days. The cotton-boll weevil does its damage by boring into the cotton boll, thus ruining the fibers. All





(1) Opening machines which break up the tight-packed bales (2) Raw cotton carried in blower tubes to *opener pickers* for untangling. (3) *Picker* machines which handle four rolls of rough cotton at a time. This is the last of the cleaning processes, in which, by beating and blowing, the cotton has been freed of all impurities.

Courtesy Pepperell Mfg. Co.

these pests can be poisoned, but the best method of controlling them is by planting disease-free seed, by fall plowing, by crop rotation, and by the raising of varieties which tend to resist the insects. Good drainage and fertilizers also aid in their control.

Harvesting. While the cotton is being cultivated, it is in the blooming stage. The small, white flowers later fall off, giving place to the boll in which the seeds bearing the fiber are produced. After six or eight weeks, many of these bolls have swollen to the bursting point, exposing a great mass of fluffy cotton. There must be several pickings of the crop, as not all the bolls open at once.

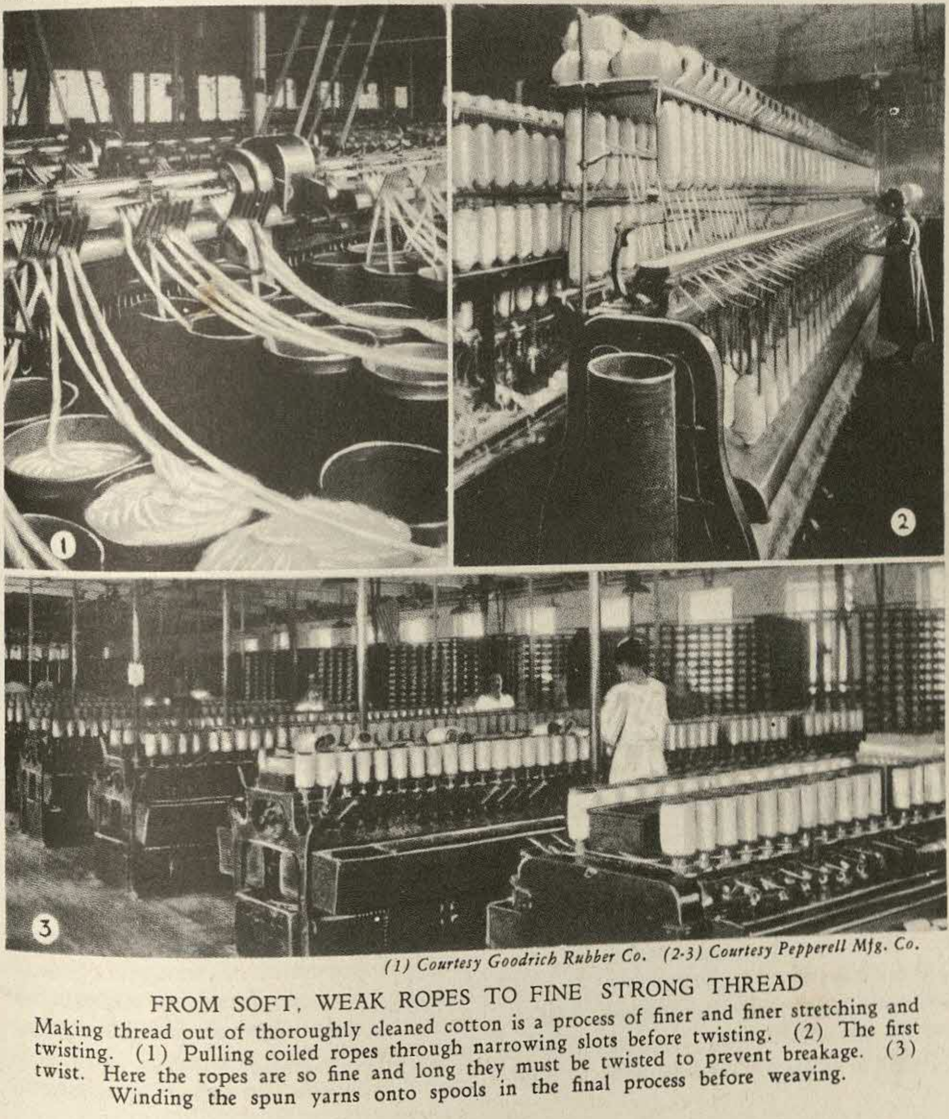
Picking begins in August and usually lasts until the middle of December. Good pickers can gather about 200 pounds daily, being careful that no trash is gathered with the cotton. Men, women, and children, both sharecroppers and day laborers, help in picking the cotton. As the bolls are picked, they are dropped in long bags which the pickers drag on the ground behind them. These bags are emptied into wagons or trucks, which haul the cotton to the gins. Here it is separated from the seeds and is then pressed into bales of about 500 pounds each. The bales, wrapped in burlap and bound by iron hoops, are then ready for the cotton market where it is classed before selling (see COTTON GIN).

Today, nearly a third of the cotton crop is picked by machine, particularly in the great cotton growing states of Texas, Arkansas, and Mississippi. Machine-picked cotton is inferior to hand-picked because it contains more trash. In addition, more cotton is lost in the field. But since one machine can do the work of about twenty pickers, it will not be many years before nearly all cotton will be machine-picked. In recent years, cotton farmers have greatly reduced the amount of trash in machine-picked cotton by spraying or dusting the plants to kill the leaves before picking begins. See Cotton Picker, Rust.

Grading and Marketing. Cotton grading is a delicate process and requires classification into one of twenty or more grades. Grading is based on cleanliness, length of fiber, color, uniformity, amount of dampness, and amount of sand.

Cotton markets begin with the small-town dealer who buys the producer's cotton and ends with the spinner. Trading in the big cotton markets may be either in *spot* cotton or *future* cotton. These great markets are thronged with buyers of cotton from spinning centers. Buyers bid on the desired cotton, and the market for the day is set by the average bid, not the high or low bid on any particular grade. Spot cotton is then shipped to consuming or export markets for spinning or for shipment abroad.

Buying is often based on *futures,* the buyer and seller setting a price for cotton which they do not have but which is to be delivered at a future date. Such transactions are necessarily only for experts in the cotton exchanges, for they must estimate



(1) Courtesy Goodrich Rubber Co. (2-3) Courtesy Pepperell Mfg. Co.

FROM SOFT, WEAK ROPES TO FINE STRONG THREAD

Making thread out of thoroughly cleaned cotton is a process of finer and finer stretching and twisting. (1) Pulling coiled ropes through narrowing slots before twisting. (2) The first twist. Here the ropes are so fine and long they must be twisted to prevent breakage. (3) Winding the spun yarns onto spools in the final process before weaving.

ahead of time the size of the crop and the probable price. If they set the price too high, the buyer is the loser; if too low, the seller loses. This is generally known as *selling short*.

The Share Cropper. Until the time of the Civil War, the one-crop system of raising cotton on Southern plantations prevailed, with slaves doing practically all the work. After the war the planters at first attempted to return to this system by hiring help, paying them monthly or twice a year, and giving each laborer three or four acres of his own to farm. When this plan did not prove practicable, the planters substituted the four-day cropping system, in which the Negro worked four days for the planter and two for himself, with the planter furnishing land, seed, and implements.

Out of this grew the present share-cropper system, which dates back nearly to the Civil War and was a definite part of reconstruction. Plantations were divided into small tracts and were farmed on shares, both Negroes and whites becoming share croppers. The planters advanced food and necessities, and the laborers received a cash share in the crop when it was harvested. Soon the stores extended credit and the share croppers bought on time until harvest, and then settled their accounts. They cultivated and picked their own cotton and the plantation owner received a share of it.

But the system has not proved successful through the years, chiefly because (1) it is a one-crop system; (2) the soil is depleted and eroded and crops become less and less valuable; (3) all land is put into cotton and the share cropper suffers from the lack of a garden. In recent years, however, there has been a definite effort toward improvement, by means of diversified crops, crop rotation, and scientific farming.

The Products of Cotton. The first cotton power weaving in America was done in a factory in Fall River, Mass., in 1817. There were two reasons for its beginning there: cheap, yet skillful European labor and an immense amount of water power. It was far easier to take the cotton from the South than to attempt to operate factories there. Since that time mills have sprung up throughout the New England States. New England produced the closer-woven materials, while in the South the manufacture of cheaper weaves prevailed. In time, however, the high cost of labor in the North caused many New England manufacturers to shift to the South.

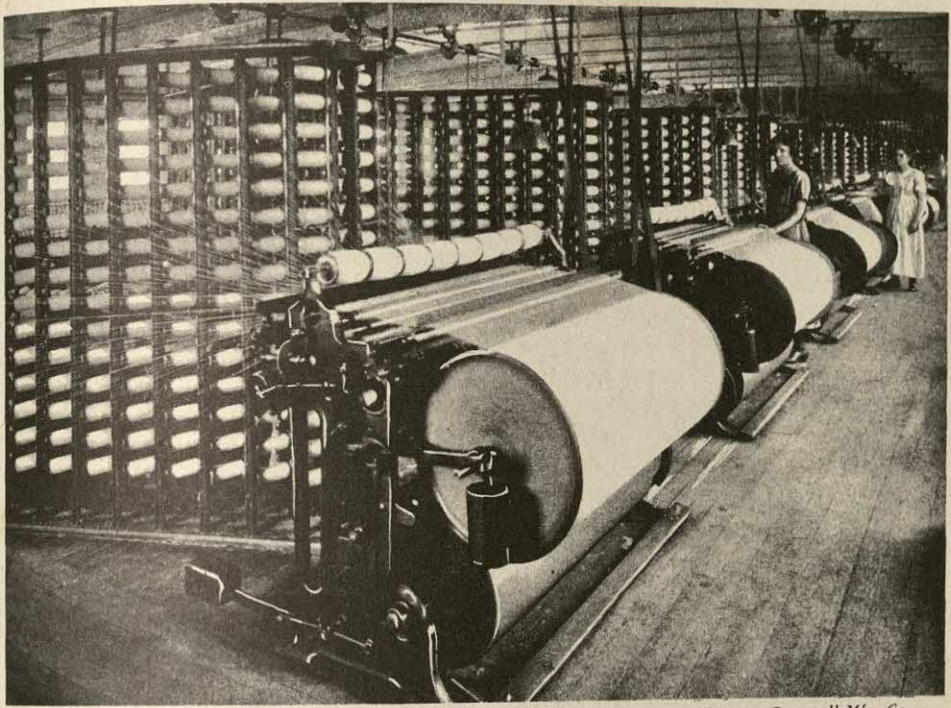
The spinning of cotton yarn and the weaving are entirely separate processes, the spinning mills supplying yarn to the weavers. Practically all yarn goes into cloth, but small amounts are retained as string, cord, and knitting yarn.

Bleaching, dyeing, and finishing processes occupy thousands of other workers, in addition to those in the spinning and weaving mills. The woven cloth must be bleached, then printed if any design is wanted, and finally dried and bolted. For woven designs, threads of different colors are intricately woven into the fabric by machine looms. Each color is printed by a separate roller, as many as seven rollers being necessary to print some materials. The designs are drawn by artists and are then engraved into copper rollers for printing (see TEXTILES).

The Cotton Millworker. Until recently, workers in the cotton mills of both the North and South were amazingly underpaid. The first power mill in America hired men, women, and children and operated from 5:00 A.M. until 7:30 P.M. For these long, tiresome hours, the men received about $1 a day, the women even less. Children were paid from $1 to $2 a week.

Today, although still far from ideal, the labor situation in mill towns has improved. The average laborer in the mill receives better pay and works shorter hours. Most of the employes doing routine work are women. Child labor has been abolished in many of the mill centers. The organization of textile workers into unions has done much to bring about improved working conditions.

In the North the labor is made up



Courtesy Pepperell Mfg. Co.

WINDING THREADS FOR GIANT LOOMS

Hundreds of strands at once come off the little spools and roll onto the huge *beams*. These machines are called *warpers*, for they are preparing the yarn which will form the vertical warp in the loom. When the yarn is on the beam, it is starched and dried to protect it from damage in weaving. At this stage the strands of the warp are called yarn in the industry.

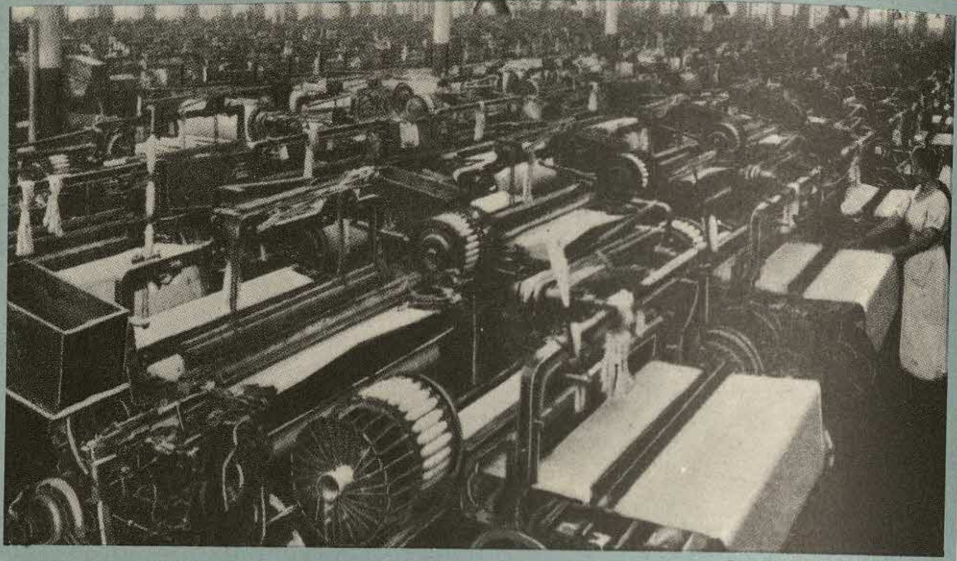
in part of the descendents of workers from eastern Europe and Canada, while in the South both Negroes and whites are employed. Despite serious competition from other textiles, cotton has great economic importance. Many states have now removed by law the causes of former clashes between employer and employe. Hours and conditions under which they work are constantly improving, and it is hoped that the day is not far off when much of the criticism now leveled at mill towns will not apply.

Cotton Products. In the early days of cotton in America, cottonseed, except that held for planting, was thrown away. Today, however, products made from cottonseed number well over one hundred and represent a large percentage of the total value of the cotton crop (see COTTONSEED PRODUCTS).

Even the stalk is used in manufacturing paper, although, like cornstalks, it is more likely to be burned or plowed under as fertilizer.

Cotton's Effect on the World. Few products are of such worldwide importance as cotton. On it depends a great part of the world's commerce. On it foreign exchange depends for much of its stability, for cotton alone has often created a balance of trade in favor of the United States that has resulted in an influx of European gold to settle this difference.

Cotton was the indirect cause of the Civil War. It will be the mainstay of wars to come because it supplies guncotton used in the manufacture of munitions. On it depend hundreds of chemists, who are daily finding new and useful fields in which cotton may improve present methods of manufacture.



Courtesy Pepperell Mfg. Co.

A FAR CRY FROM THE CREAKING HAND LOOM OF A CENTURY AGO

The weaving room of a modern cotton mill is filled with roaring, clattering mechanical looms which turn out thousands of yards of cloth a day with almost no attention. The flying shuttles even exchange their empty bobbins for full ones automatically, without stopping the looms a second.

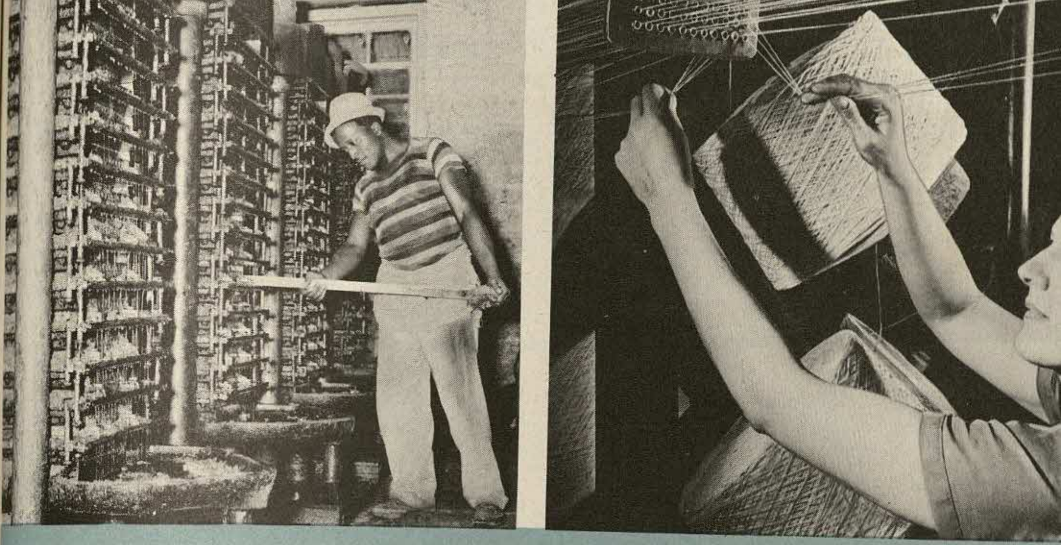
Hundreds of thousands of laborers are dependent on cotton for their very existence. The sharecroppers, the millworkers, and the sailors, clerical workers, and stevedores who send cotton on its way over the seas, are all dependent on cotton for a living.

However, King Cotton is no longer secure on his throne. The increasing popularity of rayon in recent years has given rise to fears and doubts as to the future of the cotton farm. Because of its low cost and high sales value, rayon—particularly, spun rayon—has supplanted the former product of many a cotton-weaving mill. Comparing cotton and rayon staple fibre production for two typical years, statistics show that the use of cotton decreased 455,000,000 pounds while rayon increased approximately 49,000,000 pounds. Producers of military goods during World War II made extensive use of rayon in the manufacture of fragmentation-bomb parachutes and airfield landing signals.

An interesting development was the adaptation of rayon for automobile tire production. Successful results obtained prophesied increased replacement of cotton by rayon in this important field of manufacture.

Cotton production in the United States in 1937 reached an output of 18,946,000 bales of five hundred pounds each. This output, never before attained, contrasted very favorably with the average for the entire period from 1921 to 1944—13,043,000 bales. However, because of extensive military needs for cotton during World War II and the shortage of the manpower required for picking and processing the cotton, every piece of cotton goods produced was in demand. In an effort to satisfy military and civilian requirements, cotton farmers in one year produced an unprecedented yield of nearly 400 pounds an acre.

Recent Legislation and Crop Control. The government production-control programs went into effect in 1933 with the plowing up of about one fourth of the acreage planted in cotton. In subsequent years, from 1934 on, farmers received compensation for non-planting of the staple in



U.S.D.A.; United States Rubber Co.

WE EAT, RIDE ON COTTON PRODUCTS

Oil for food is pressed from cottonseed in giant presses, left. Cotton cord for use in automobile tire casings is carefully checked for breaks, right.

varying percentages. Further attempts to reduce surpluses and thereby raise farm income were made under the Agricultural Adjustment Administration. During World War II, the AAA, which became a part of the Agricultural Conservation and Adjustment Administration, helped acquaint individual farmers with the nation's needs and with their part in achieving specific production goals. A crop-insurance program also assisted many cotton growers. After the war the government aided the cotton industry by supporting prices.

The World Picture. World production of cotton ranges from 25,000,000 to 30,000,000 500-pound bales yearly. At one time the United States raised more than one half of the world's cotton, and even today it produces from two fifths to one half. Next come India and the Soviet Union. China, Brazil, and Egypt produce important quantities, and cotton is grown on a minor scale in several lands, particularly in Mexico, Argentina, Turkey, Anglo-Egyptian Sudan, Uganda, French Equatorial Africa, and French West Africa.

In the United States, Texas produces from one fifth to one fourth of the total crop. Mississippi for many years has averaged more than 1,500,000 bales, Arkansas more than 1,250,000 bales, and Alabama more than 1,000,000 bales. Lesser amounts are produced in Georgia, South Carolina, North Carolina, Oklahoma, Louisiana, and Tennessee. The most notable development in cotton growing in recent years has been the emergence of California as a leading cotton state.

Before the Industrial Revolution, India led the world in the production of cotton goods, and cotton processing in Europe consisted largely of dyeing the manufactured goods imported from India. By the eighteenth century, however, English textile workers were weaving cotton, and in the early nineteenth century England, with its new textile machinery, became the chief commercial producer of cotton cloth. The United States did not replace Great Britain as world leader until after World War I.

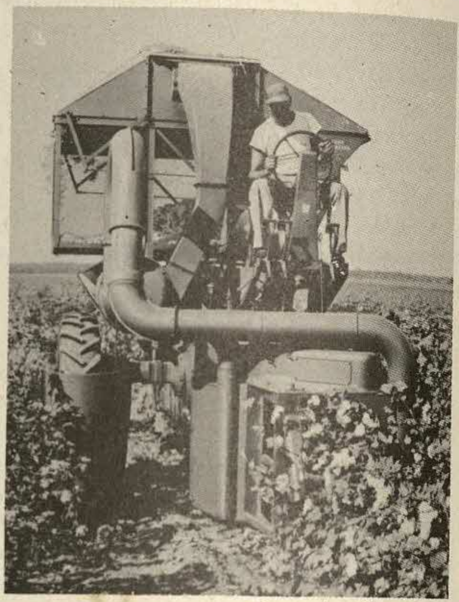
The decade of the 1920's was a period of great expansion in cotton textiles in the Far East, with Japan outdistancing India and China to become one of the giants of international commerce. In Europe, Germany and the Soviet Union manufactured cotton goods in huge quantities, and in South America, Brazil forged ahead in the cotton industry. World War II brought many changes, but American cotton men face strong competition. To help the situation, Congress passed the Surplus Disposal Bill, which authorized exporters to sell American cotton at world prices from November 15, 1944, to January 1, 1946. In the years that followed, periods of short supply alternated with periods of surplus cotton, causing serious economic problems for both farmers and the government. See AGRICULTURE, subhead *King Cotton*.

COTTON, JOHN (1585-1652). This Puritan clergyman and scholar was prominent in the church and civil affairs of the Massachusetts Bay Colony. Born at Derby, England, he was educated at Trinity College, Cambridge, where he later became a tutor. While vicar of a parish in Lincolnshire, England, he changed certain ceremonies of worship to conform with his Puritan views. Because of these changes he was summoned to appear before the high commission court. Instead, he fled to Boston, Mass., where he preached and wrote until his death. He was the author of several controversial pamphlets, a catechism for children, and forms of prayer. In a dispute with Roger Williams, Cotton took the stand that the state had the right to interfere with man's religious affairs.

COTTON BOLL WEEVIL. See BOLL WEEVIL.

COTTON GIN. If ever a machine caused a war, it was the cotton gin. Coming as it did in 1793, when the English mills were demanding more and more cotton, it was the direct cause of the spread of slavery in the South. For at that time, slavery was the only solution to the plantation labor problem.

To Eli Whitney belongs the honor of the invention of the cotton gin. A shrewd Yankee, he saw that what prevented an unlimited production of cotton was the lack of a quick method of seeding it. The cotton gin (a shortened form of *cotton engine*) was the result. Whitney's first gin was merely a wooden cylinder fitted with strong wire teeth rotating between vertical wires held in a frame. As the cylinder revolved, the teeth drew the fiber through the wires; the seeds, being too large to filter through, fell to the ground.



International News Photo

REMEDY FOR BACKACHE

Picking cotton by hand has always been backbreaking toil. Mechanical pickers not only put an end to strained muscles, sore fingers, and weary legs but also do the work in about one-sixtieth the time hand pickers require.

The modern cotton gin has replaced the original, with about seventy saws which function in much the same way as Whitney's machine. From the power-driven gin the lint or fiber is blown or sucked through a lint chute to the press box, where it is pressed and baled. A roller gin, rather than a saw gin, is used in handling sea-island cotton, in order to protect the fiber. See COTTON; WHITNEY, ELI.

COTTON PICKER. Two types of machines are used today for picking cotton. One is the stripper, which uses finger-like projections to strip the stalks of the cotton plants as it is drawn by tractor through the fields. The other type is the spindle picker. One of the first successful spindle pickers was the Rust Picker.

Unlike most of the previous suction pickers, the Rust Picker gathers very little trash along with the cotton. Drawn by a tractor, this machine straddles the cotton row. It clutches the cotton bolls on its 3,600 moistened and revolving spindles and holds them firmly until they are released into a trough. The cotton is then forced by compressed air through a pipe into a metal basket. Several other excellent pickers, all of the spindle type, also are in use today. Only one man is required to operate any of them, and each machine can do as much as a large number of hand pickers. Usually traveling from two to three miles per hour, these machines can pick from 90 to 96 per cent of the open-type of cotton from a field. The stripper is used in Texas, Oklahoma, and other regions where the storm-resistant type is grown. The bolls of storm-resistant cotton do not open and expose their contents to the weather.

Although pickers and strippers are not extensively used in other countries, they are now widely employed throughout the cotton-producing areas of the United States. During and after World War II, both the cost and the scarcity of labor there made it almost essential for growers, especially large ones, to use machines in order to produce their crops cheaply enough to compete with less expensively produced foreign cotton and with an ever-increasing number of inexpensive synthetic fibers. Small growers who could not use mechanical pickers efficiently and economically turned to other crops; and many hand pickers, thrown out of employment, became industrial workers. See COTTON.

COTTONSEED PRODUCTS. In the early days of the cotton industry, cottonseeds, except the small amount saved for planting, were thrown away or burned. Today, as a result of modern chemistry, they are so valuable industrially that cotton is sometimes grown for its seeds exclusively, rather than for its fibers.

After cottonseed is freed of fiber, lint, and hulls, it is pressed in giant crushers to produce cottonseed oil. This yellow oil is utilized in numerous ways. The finer grades are used in the production of oleomargarine, cooking-oil substitutes for lard, salad oils, and sardine oils. The poorer grades are used in making soap, paint, cosmetics, putty, tar, composition roofing, and photographic films of dependable grade.

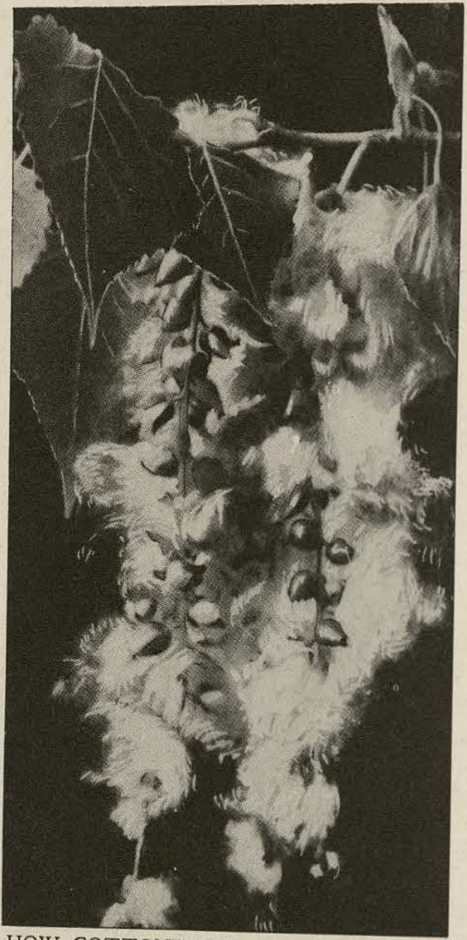
DELICACY ON A COTTONWOOD
Poplar leaves tremble in the lightest breeze.

After all the oil has been squeezed from the seed, a hard, dry mass known as cottonseed cake remains. This cake is ground into cottonseed meal, mixed with cereals, and fed to cattle. Mixed with acid phosphate, cottonseed meal becomes a valuable fertilizer, furnishing an abundance of nitrogen, valuable as a plant food.

The coverings of the seed, the hulls, are made into paper, chemicals, roughage for cattle, and cheap fertilizer, though the hulls are usually burned and the ashes used for fertilizer.

The linters, or "fuzz" collected from the seed, are baled and later employed in the manufacture of wadding, upholstery, cheap yarns, paper, rayon, and a number of other cellulose products.

COTTONWOOD. The tiny fluffs of downy cotton seen floating in the air during early summer are from the seed balls of the cottonwood, a member of the poplar genus of trees. It has often been called the



HOW COTTONWOOD GETS ITS NAME
The seeds of this tree develop in a fluffy, pendant mass looking like spun cotton. The light, airy puff is sown by the wind.

"necklace tree" by children who string the green seed balls as beads. Cottonwoods are common in the Eastern and Central states. Because of their great height, rapid rate of growth, and little need for water, the early settlers planted them near their homes in the West to provide windbreaks and shade. Trees which do not produce seed bear red catkins which resemble caterpillars. The bark is a grayish brown, and the leaves, which create a soft rustle in the lightest breeze, are a glossy green.

In modern landscaping, the cottonwood is not favored because the wood is very brittle and breaks easily in the wind, causing the tree to become unshapely. It is used in making packing cases, barrels, woodenware, and pulp.

COUGAR, *koo'gur.* See PUMA.

COUNTERFEITING, *koun'tur fit ing.* Government agents are quick to detect counterfeit or false money and are relentless in tracking down and convicting the criminals who foolishly try to get rich through counterfeiting.

Severe Federal penalties and long prison terms await anyone who makes or passes bogus coins or bills. Counterfeiting is a crime against all the people of the nation, a malicious attempt to procure valuable goods or services with money which will never be honored by the government.

While the term is commonly applied to the imitation of money, any other article may be counterfeited.

COUNTER-REFORMATION. Opposed to the early sixteenth-century movement in Europe known as the Reformation, or the Protestant Revolt, was the Counter-Reformation or, more exactly, the Catholic Reform. In general, this movement was designed to stop the spread of Protestantism and to correct the abuses within the Catholic Church.

The religious aspect of the revival took the form of an attempt on the part of churchmen to bring back a more vital and genuine Catholic life. One important factor in the Counter-Reformation was the Council of Trent, which met from 1545 to 1563. Doctrines denied by Luther and his followers were restated by the Council and existing abuses within the Church were corrected. The Council also prescribed a series of sweeping disciplinary reforms.

Politically, the Catholic Reform was energetically carried out by many Catholic rulers because of the breaking away of many parts of Germany under Luther and the general spread of Protestantism over Europe. In Italy and Spain the Reformation made no headway; in Bohemia it was stopped only after the Thirty Years' War. See REFORMATION, THE; THIRTY YEARS' WAR; LOYOLA, IGNATIUS OF.

COUNTY. If you examine a map of the United States, you will find it divided into many different sections called *states.* These states, in turn, are divided into smaller units called *counties.* Most of us live within areas called counties. Some of us live in a city called a county seat. Chicago is a city in Cook County and is also the county seat. The town which is chosen as the county seat is the center of county government.

Counties first came into existence during the reign of Charlemagne in the ninth century. He divided the land into small sections and appointed royal representatives, or counts, to govern them. When the Normans invaded England in 1066, they found governmental areas called *shires.* Because of their similarity to the counties in France, the name county came to be used in England.

In the United States, state legislatures establish counties with legally defined boundaries and grant them certain privileges of self-government. They collect taxes and maintain public roads, bridges, and schools. Counties have even smaller units within them, including cities, townships, and school districts. A county usually is governed by a board of commissioners elected by the citizens within the area. Other officials include a clerk, a sheriff, a probate judge, a school superintendent, and a coroner. There are more than 3,000 counties in the United States. In Louisiana counties are known as *parishes.*

COURT. In every civilized country, courts exist to settle the differences between men and to administer justice according to the laws of the land. Judges or juries receive the facts of a case and pass judgment. Here, too, unofficial laws are established, for each decision made may become the basis for future judgments.

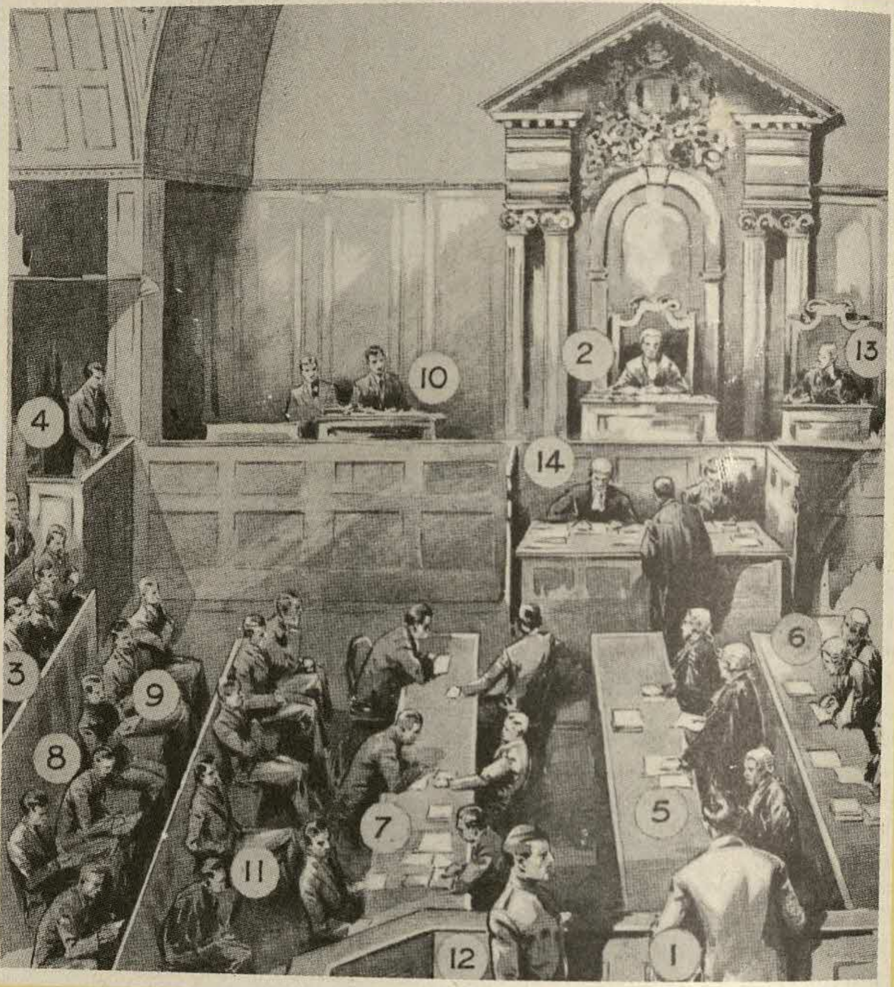
A court may consist of a judge alone, or of many judges. The court of a justice of the peace or police magistrate is an example of a one-man court. The United States Supreme Court and the supreme court of each of the states are courts of many officials. Besides judges and juries, the persons associated with courts may include sheriffs, bailiffs, clerks, reporters (who transcribe the testimony), and attorneys.

Into a court come individuals who have disagreements: for instance, neighbors who differ about the boundary between their properties; individuals who believe they have been wronged—such as the man who sues to make another pay money due on a note; other individuals who wish the court to order or permit certain things to be done—for instance, the widow who must have the court's approval before she assumes control of her husband's property. There come also the individuals who are accused of violating laws which say, "Thou shalt not." Any of these people may be individual persons, or they may be representatives of corporations, which in the eyes of law are individuals. Occasionally a government is one of the parties in a court case, and it is technically one of the parties in every criminal prosecution.

Usually each individual concerned in a case in court is represented by an *attorney* (in the British Commonwealth of Nations by a *barrister*), who endeavors to obtain from the court a favorable decision for his client. In most cases, witnesses appear and are questioned by attorneys and sometimes by a judge.

Except in very minor courts, procedure follows a definite program, and before a case can come before a court, it must be entered on the list known as the *court calendar.* Usually the cases on the calendar come to trial in order of their entry.

American Courts. In the United States there are two forms of court—state and Federal courts. Lowest of the state courts is the justice of the peace, who hears suits involving small amounts of money and minor offenses. For more serious offenses, there is a county court, which is usually the court where wills are filed and probated, and misdemeanors tried. Circuit courts hear criminal cases, divorces, and suits of greater importance. Above the circuit court stands the state supreme court, to which



THE COURT—BASIS OF ALL LAW ENFORCEMENT

This is the English Criminal Court, most famous of all tribunals. (1) Prisoner. (2) Judge. (3) Jury. (4) Witness being questioned by lawyer (5). (6) Other lawyers. (7) Legal assistants. (8) Reporters. (9) Police. (10) Judge's clerk. (11) Ushers. (12) Guard. (13) Sheriff. (14) Clerk of the Court. American court procedure is much the same from a legal standpoint, but far less formal. United States courts have no sheriff, no ushers, no judge's clerk. The prisoner does not need to stand, nor does the witness.

cases may be appealed after trials or hearings in the lower courts.

Federal courts are organized on much the same plan, being divided into district courts, circuit courts of appeal, and the Supreme Court. The district courts, along with the courts in the territories, hear cases involving Federal laws. The cases may be appealed to the circuit court of appeals. The Supreme Court passes directly only on cases involving ambassadors, ministers, and those in which a state may be a party. Other cases may come before it only if they involve cases from the lower Federal courts.

Canada has a similar system, except that the provincial judges are appointed and largely paid by the national government, whose courts consist of a Supreme and an

Exchequer Court. See the title CANADA.

For additional information, consult the following articles:

- Court of Claims
- Judge
- Jury and Trial by Jury
- Justice, Department of
- Justice of the Peace
- Juvenile Court
- Law
- Supreme Court

COURT FOOL. In times past and in many different countries, court life was made gay and joyous by the king's fool or jester. Amidst the usual gorgeous array of regal splendor, this fool mocked and mimicked those who took themselves too seriously, and his merry quips and antics provided gaiety and mirth at feasts and balls. This jester, who sometimes was a dwarf, ordinarily sat by the king, and wore a costume of brilliant colors, donned a wide collar, and topped his head with a cap outfitted with bells and ass's ears.

The modern counterpart of the king's jester is the circus clown, the "slapstick" comedian of the motion picture, and the "dummy" in the ventriloquist act.

COURT-MARTIAL, *mar'shal.* Offenses committed in the line of duty by members of a country's armed forces are tried in special courts called *courts-martial.* Members of the service involved act as judges, lawyers, and juries. In the United States Army minor offenses are tried by *summary* courts-martial; more serious ones by *special* courts-martial. Those involving commissioned officers and those for which death may be the penalty are tried by *general* courts-martial. The Navy and the Air Force have similar courts. In 1950 Congress established the United States Court of Military Appeals for reviewing court-martial decisions.

COURT OF CLAIMS. According to the United States Constitution, no American citizen may sue the Federal Government. However, any citizen who feels that he has been wronged by the government or its agents may appear before the United States Court of Claims and ask for justice. If the judges feel that the plaintiff is entitled to damages, he is paid from a special fund set aside for the purpose by Congress and handled by the General Accounting Office.

FEATHERED BULLY

The cowbird is a very unpleasant good - for - nothing among birds, crowding songsters from the woods.

This court was established by a Congressional act in 1855 and is presided over by a chief justice and four associate justices. Appointed by the President, with Senate confirmation, they may hold office for life, or during good behavior.

COW. See CATTLE.

COWBIRD, or COW BUNTING. Best known for its habit of laying eggs in the nests of other birds, the cowbird is the villain of the blackbird family. The male cowbird is about eight inches long, and in color is a shiny black with metallic reflections, except for the head and neck, which are brown. The female is grayish brown, lighter below. The birds are usually seen in small groups, except in the fall when immense flocks of them associate with red-winged blackbirds in the marshes.

The best-known species is found throughout the United States, Southern Canada and Mexico, those in the North moving to the Southern states and to Mexico in winter. They are often seen in the fields with cattle, close under the animals, watching for insects that are stirred up. Thus has come their name. Their food consists mostly of insects, weed seeds, and grain; and from an agricultural point of view they are useful rather than harmful in themselves. But for every one that grows up, three or four other useful birds are sacrificed, and for this reason both the bird lover and the farmer have little liking for the cowbirds.

The story is a strange one. In May and June when other birds are nesting, phoebes, song sparrows, chippies, vireos, yellow warblers, and many others, the female cowbird leaves her companions long enough to lay her egg beside those of the rightful owner. Then she forgets it. The cowbird hatches sooner than those of the sitting bird, and the younger cowbird is a big, greedy rowdy who soon crowds out or starves out the real owners of the nest. It is a curious sight to see an adult yellow warbler or chippy feeding a cowbird larger than itself, but this often happens. Sometimes a bird on finding its nest invaded abandons it, or seals it over and builds again on top. But often it leaves the neighborhood entirely after such an experience. On the whole the cowbird is an outcast in the bird world, and does not deserve protection or support.

WESTERN HILLS
Great plains, home of roaming herds of half-wild horses: the "bronco-busting" cowboy—these are the symbols of the West to every American.

COW'BOY. During the American Revolutionary War, the name cowboy was sometimes applied to a cattle thief, but today it refers to a mounted herdsman employed in caring for cattle on the Western ranges of the United States and Canada. Before the range became fenced, cattle grazed over wide stretches of territory, and the only means their owners had of keeping them under supervision and control were by the services of men in the saddle. Besides supervising grazing and watering, cowboys held round-ups, when calves were roped, branded, graded, and dehorned; the cattle were also driven overland to markets.

John A. Lomax, in his book, *Cowboy Songs and Frontier Ballads,* gives us the picture in these words:

> The changing and romantic West of the early days lives mainly in song and story. The last figure to vanish is the Cowboy, the animating spirit of the vanishing race. He sits his horse easily as he rides through the wide valley, enclosed by mountains clad in the gay purple of coming night, with his face turned steadily down the long, long road, "the road that the sun goes down."
>
> A vagrant puff of wind shakes a corner of the crimson handkerchief knotted loosely about his throat; the thud of his pony's feet mingling with

THE MARK OF OWNERSHIP

Cowboys on a Wyoming ranch tackle the annual job of branding cattle. Nobody has yet devised a better identification mark than that made with a hot iron. Every ranch has its own brand, so stray cattle are easily recognized and returned to the owner. Sometimes, cattle are marked by notching their ears. Thanks to machines, today's cowboy has more leisure than ever before. Cattle are trucked, rather than driven, from range to range. Strays are hunted down by airplane and helicopter. Even fence-building and ditch-digging have been mechanized.

the jingle of his spurs is borne back, and as the careless, gracious, lovable figure disappears over the divide, the breeze brings back to the ears, faint and far, yet cheery still, the refrain of a cowboy song.

Whoopee ti yi, git along little dogies;
  It's my misfortune and none of your own.
Whoopee ti yi, git along little dogies;
  For you know Wyoming will be your new home.

Few figures in American rural life are of such individual and outstanding character as the typical cowboy.

COWPEA. Closely related to the bean, the cowpea is a legume widely used as forage and plant fertilizer, especially in the southern part of the United States. In general, it is adapted to about the same climatic conditions as corn, but requires somewhat more heat. The cowpea is a summer annual and belongs to the general family of leguminous plants. In appearance it resembles the bean, and varies in habit of growth from an upright, bushlike form to a mass of low, trailing vines many feet long. About fifteen varieties are in common cultivation in the United States.

The cowpea is of ancient cultivation for human food, and this is still the case in all Old World countries where the crop is grown. Although in the United States the plant is grown mainly for soiling, hay, ensilage, and pasturage for all kinds of stock and as a soil-improving crop, nevertheless the seeds, especially of the white and black-eyed sorts, are generally and favorably known as a staple human food in the Southern states. The cowpea has been used more as a soil renovator than any other legume because it is so easily grown, has such a marked effect upon succeeding crops, and succeeds under such a diversity of conditions. Cowpea seed is sometimes fed to poultry, but is rarely cheap enough to use generally as feed.

COW'PENS, BATTLE OF THE. A decisive blow to British hope of success in the South, during the Revolution, was administered by General Daniel Morgan on January 17, 1781. Commanding an American force of about a thousand men, he defeated the army of Colonel Banastre Tarleton in the Battle of the Cowpens, near King's Mountain, South Carolina. Attacked on both flanks, the British, numbering 1,100, lost, in captured or killed, their entire force with

COWPENS—A VICTORY FOR COLONIAL SHARPSHOOTERS
In this battle, fought near King's Mountain in North Carolina, a thousand colonial soldiers under the leadership of Morgan decisively defeated the British regulars. The engagement ended with the capture or death of most of the British soldiers.

the exception of 270 men, who retreated in safety. Twelve Americans were killed and sixty-one were wounded. This battle marked the last real effort of the British to dominate the Carolinas, and the fighting shifted north into Virginia, where it soon ended with the surrender of Cornwallis at Yorktown. See REVOLUTIONARY WAR IN AMERICA.

COW'PER, WILLIAM (1731-1800). This English poet does not rank with the greatest verse writers of his country, but he holds an important place in the development of English literature. Writing at a time when English poetry lacked imaginative beauty, he helped to prepare the way for the Romantic movement, which came to full flower with Wordsworth and Shelley. Cowper's own verse has elements of inspiration and displays a sympathetic understanding of traits that are characteristic of the Romantic writers.

The son of a minister, Cowper was born in Hertfordshire, England. The death of his mother, when he was six, and his unhappy experiences in a boarding school had their effect on the sensitive boy, and he suffered all his life from a tendency to melancholy.

Cowper studied law and was admitted to the bar in 1754, but in temperament he was wholly unsuited to a legal career. Accordingly, his family secured for him a position as clerk of the House of Lords, but the prospect of an oral examination so disturbed him that he became insane. Through careful nursing and the friendship of the Unwins he recovered. After the death of her husband, he accompanied Mrs. Unwin and her children to Olney. There Cowper wrote his famous *Olney Hymns,* including the well-known *God Moves in a Mysterious Way* and *There Is a Fountain Filled with Blood.*

The poet's best work, *The Task,* appeared in 1785. Written in blank verse, it contains much beautiful and inspirational description of nature. In 1791 he published a translation of Homer, but ill health, both mental and physical, prevented further sustained effort. Outstanding among his shorter poems are *The Diverting History of John Gilpin, To Mary, On the Loss of the Royal George,* and *Alexander Selkirk.* The letters written by Cowper to his friends are delightful.

COW'SLIP. Several flowers are known popularly as cowslips. There are three species in America to which the name is applied. One of these is the *marsh marigold,* a swamp flower belonging to the buttercup family. It bears satiny yellow flowers and bright-green leaves, the latter often eaten as greens. In the Western states is the *shooting star* or *American* cowslip, a member of the primrose family. The *bluebell* or *lungwort* of Virginia, belonging to the borage family, is also called cowslip.

The cowslip of England is the *primrose,* a lovely herblike plant with fragrant yellow flowers set in a rosette of spreading green leaves.

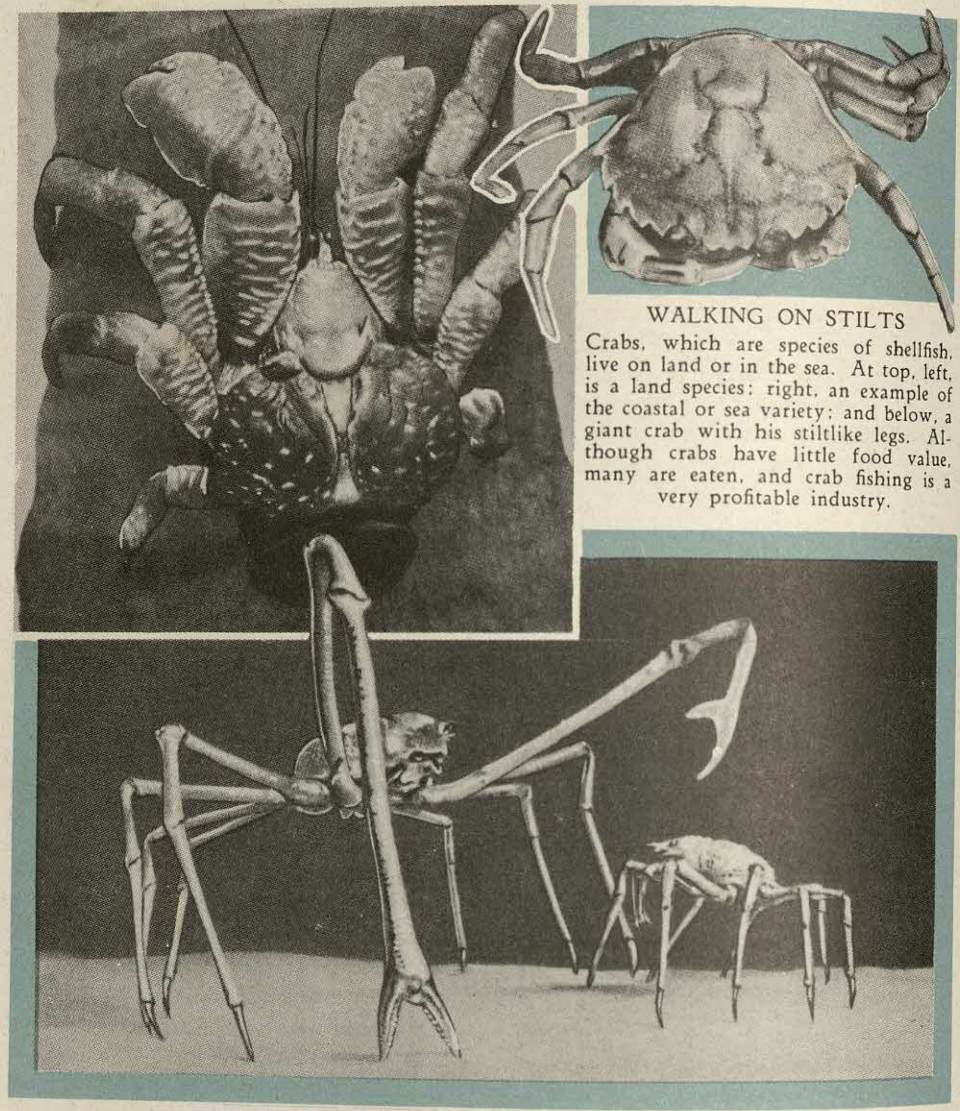
COYOTE, *ky o'te,* or *ki'ote.* A coyote is about as large as a setter dog, and has a long, bushy tail. Its slinking ways and evil eyes betray its kinship with the wolves; in fact, it is known as the "prairie wolf." Coyotes are generally grayish in color, shaded with black and reddish tones. They are typical animals of the sparsely populated open plains and sagebrush country, but they also range up mountain sides to points above timber line and show the most remarkable ability to persist and thrive in well-developed agricultural regions; for coyotes increase rapidly, are extremely cunning, and eat a wide variety of food. Their young are born during the spring months. Litters of six to ten are common, the number occasionally running as high as fourteen.

THE PRAIRIE WOLF

Characterized by slinking habits, the coyote is a member of the wolf family. He preys on rodents and birds.

While young, inexperienced coyotes are relatively easy to trap, they quickly acquire the greatest cunning in the capture of their prey, in avoiding skillfully placed traps, and in keeping out of rifle range. They are ever watchful, alert, and suspicious and exhibit marvelous speed in making away from any object which causes alarm. They feed extensively upon the eggs, young, and adults of poultry and all kinds of ground-nesting or dwelling birds, including such important game birds as quail, grouse, ducks, and turkeys. Their bill of fare includes also injurious rodents such as mice, ground squirrels, prairie dogs, and jack rabbits. Larger game animals, such as deer and antelope, especially the young, they kill in large numbers. Pressed by hunger, they will subsist also on carrion. The diet is varied with such vegetable foods as wild berries, grapes, acorns, nuts, corn, melons, and garden products.

With the settlement of the Western country, coyotes have been quick to avail themselves of the abundance of food provided by the poultry, sheep, pigs, and calves



WALKING ON STILTS

Crabs, which are species of shellfish, live on land or in the sea. At top, left, is a land species; right, an example of the coastal or sea variety; and below, a giant crab with his stiltlike legs. Although crabs have little food value, many are eaten, and crab fishing is a very profitable industry.

of the farmer and stockman. The losses caused by them have been so serious as to place a heavy handicap on the raising of livestock and poultry, and in many sections have made the business so unprofitable that it has been given up. Recognition of this fact has led to the organization of great co-operative campaigns for the destruction of coyotes, in which traps, guns, and poison are used systematically to reduce their numbers. Coyote pelts in prime condition have a market value for fur.

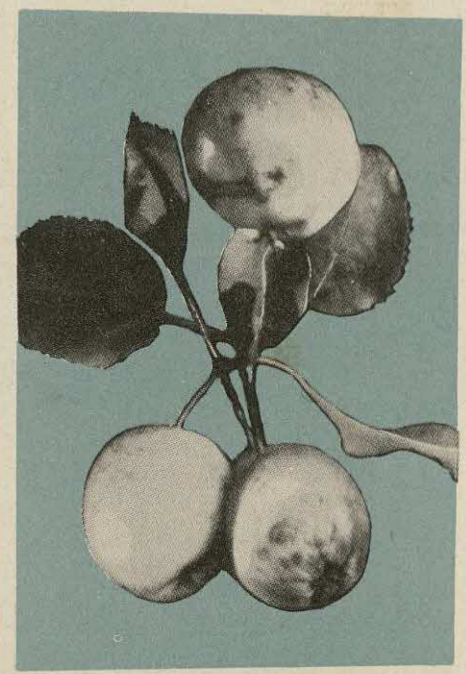
CRAB. Nearly a thousand species of crabs are found throughout the world. Crabs are shellfish, related to lobsters. Some live in fresh water, some on land, but most of them live in salt water. Among the best-known varieties are the *fiddler* crabs, the *hermit* crabs, and the *blue* crabs. The last are the most valuable as food in the United States and Canada, and many millions are caught each year. Once every three or four years they shed their shells, and for a short time thereafter are known as *soft-shelled* crabs. They are then considered best for market and are usually sold at a premium.

To catch crabs, all a fisherman has to do is to tie a string on a dead fish and throw it overboard. When the string begins to twitch, he draws the fish in carefully and usually finds the crab still hanging on. Just before lifting the bait out of the water, he slips a dip net under the crab. Commercially, crabs are caught from baits hanging at intervals of a few feet on long lines between stakes, or in baited wicker traps.

A crab usually has a part of its body folded beneath. This peculiarity makes crabs appear shorter and broader than lobsters. They seem to be able to move equally well sidewise, backward, and forward, and are able to give a severe pinch with their claws. The eggs are carried by the mother crabs until hatched. The young then look much different from the parents, and swim about freely. After a number of changes of the shell, however, they look like the adults and grow larger with each molt.

CRAB APPLE. The common, cultivated crab apple is the Siberian crab apple, native to Siberia and southward to Manchuria and North China. It produces small, hard, sour, yet highly flavored fruit, which is mainly used for jellies, preserves, and other cooking purposes. It is rarely used as a fresh dessert fruit, except in colder climates where the common apple cannot be grown. Its cooked products have a sprightly, delicious flavor, in some respects superior to those of the common apple. The crab apple is now grown generally throughout the temperate climates of the world.

The name crab apple is also quite widely applied to almost any apple which bears small, sour fruit. In the Old World there are many species of crab apples aside from the Siberian crab. Their fruit is generally small and of little or no value, but many of them are in cultivation because of the beauty of their flowers. See APPLE.

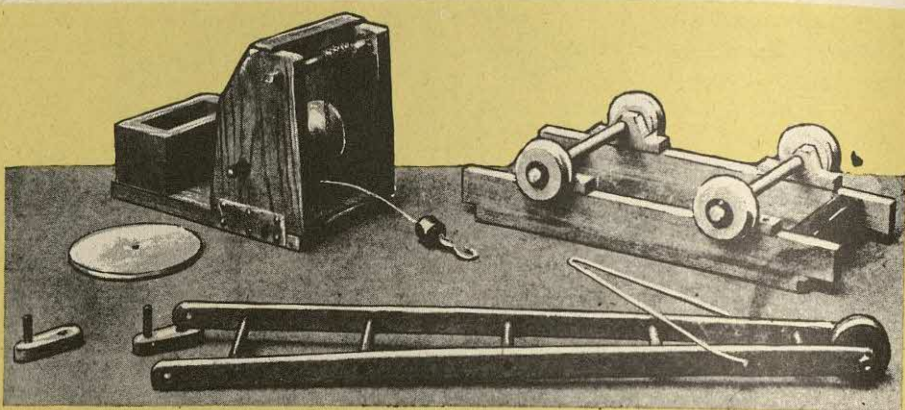


A CLUSTER OF WILD APPLES

The crab apple is the highly prized source of many delicious preserves and jellies. Many varieties are grown in the United States, particularly in the East and Middle West.

CRANBERRY. Shiny red cranberries grow on a trailing plant of swamps and bogs in cold temperate climates. The small acid fruits are highly prized for cooking purposes and, as they keep well, are marketed all over the country. The cranberry belongs to the same family as the farkleberry and the blueberry. The flower bud and the curved stalk on which it hangs resembles the head and neck of a crane in shape. This is said to have suggested the name craneberry, which has been shortened to cranberry.

There are two chief kinds, or species, of cranberries. The *small-fruited* cranberry is found in Northern Europe, as well as in the United States and Canada. Its fruit is extensively gathered from the wild plants in their native bogs. The *large-fruited* cranberry is native to North America. It is the most popular cranberry, on account of its larger fruit, though in quality of fruit the smaller species is its equal. The cranberry is eagerly sought wherever it grows wild, yet it has come into cultiva-



How to Build a Model Crane

THIS model can be easily made with a few pieces of soft wood, one large and one small spool, and pieces of large wooden knitting needles or dowels.

The Platform. Saw out and smooth a piece of ⅜″ wood, 8″ x 3½″ (*A*, Fig. 1). Make wheel bearings of ⅛″ stock, to size shown at *B*. The ⅜″ side pieces, *CC*, are cut as at *G*, with holes on center line just big enough to let dowel turn easily.

The Jib. Make jib of two pieces of ¼″ wood, as at *D*, and assemble ½″ apart with dowels and glue. The drum shaft is 2½″ long. Pulleys, at tip of jib and at *F*, are sawed from the smaller spool, as are the wheels.

The Winding Drum. Cut the large spools to fit snugly between the side pieces, which should be 1¾″ apart when fixed to the platform. Fix a piece of dowel 3″ long tightly in the hole of the drum. Then screw one side piece to the platform from beneath, place jib and drum in position, and screw down other side piece. To strengthen sides, brace with panels screwed between, front and back. The winding handle is made as at *H*, and held on the drum shaft with a small screw. Fasten down rear end of jib with chain and hook. Make driver's cab of ⅛″ wood and toy wheel on piece of dowel.

Ready for Work. Now screw wheel bearings on platform and attach wheels with washers and round-headed screws. Wind five yards of thin strong twine on the drum and pass the end over the pulleys. Attach small hook, and the crane is ready to pick up a good-sized load. To make the model look like massive full-scale equipment, apply a coat of lacquer, making body gray, wheels red, and jib blue.

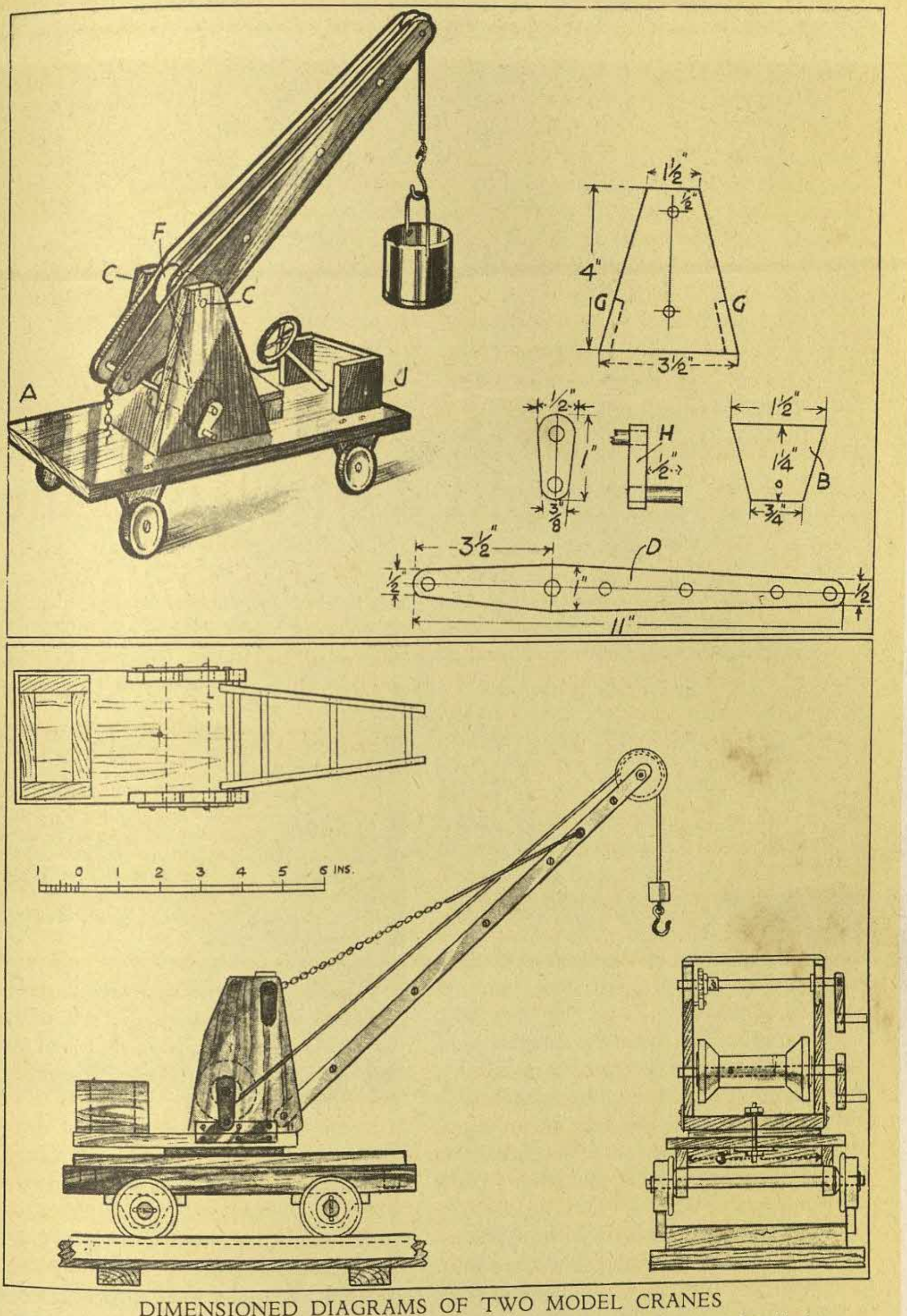
---

tion only in the United States and in Southern Canada.

The cultivation of the cranberry began on Cape Cod Peninsula, in Massachusetts, over a century ago. Early culture began by improvement of the wild cranberry bogs, so as to afford more favorable conditions for the plants. Some of the steps in improvement have been the removal of other wild plants that compete with the cranberries; the draining of areas too constantly flooded; setting plants in vacant areas to secure a full stand; pruning the plants (usually by mowing with a scythe) to secure clean new growth; and propagation from the plants that produce the finest fruit, to secure improved varieties.

A good cranberry bog should produce from 150 to 600 bushels of fruit per acre. Annual production in the United States runs over 20,000,000 bushels. Leading cranberry-producing states are Massachusetts, New Jersey, and Wisconsin. The distribution of production extends from New England to North Carolina and west to the Dakotas and Arkansas, with some yield from Pacific-coast states.

CRANE. Wherever weights too large for men to move have to be lifted and transferred from place to place, you will find a machine called a crane doing the heavy work. The most common of all cranes is the ordinary derrick. The derrick consists of a beam whose top is held in



DIMENSIONED DIAGRAMS OF TWO MODEL CRANES

The upper drawing gives the principal dimensions of the working model crane described on the opposite page. This model can be quickly constructed with a few tools and easily obtained materials. A model large enough for a young engineer to sit in and strong enough to handle fairly heavy loads can be made by multiplying the dimensions given, by five. The lower scaled drawing indicates how a slightly different type of working model crane may be made. This practical model has an adjustable boom and rail wheels.

position at an angle; and a lifting pole whose outer end is raised and lowered from the top of the beam. It has also a large drum on which the cable is wound, and some means of power, either a hand crank or an engine. This type of crane is most commonly used in constructing tall buildings. It will swing in a complete circle and is often used in loading ships.

Another more complex crane is the traveling crane. This type operates on an overhead track and is capable of lifting locomotives, carrying them from place to place, and setting them down gently. It is usually operated by two engines or motors, one to propel the crane along the track, the other to do the lifting. This type of crane is used almost exclusively in steel mills, locomotive works, or any place where heavy weights must be moved. It is operated by a skilled worker who sits in a little control room. This room moves back and forth from side to side and gives the operator a complete view of the floor below.

Without the use of cranes for heavy lifting, many of our larger industries could not operate, for heavy articles are manufactured that could not possibly be moved in any other way. It is a striking example of how man has harnessed electricity to save labor and perform otherwise impossible tasks.

CRANE. In the bird section of the zoo there are no more interesting creatures than the long-necked, long-billed, and long-legged cranes. The amusing appearance of the crane is for a very special reason, for it is a swamp bird and its long legs, flexible neck, and extended bill help it to dig out the snails, fish, worms, and frogs that live in the water and mud at the bottom of the marshes.

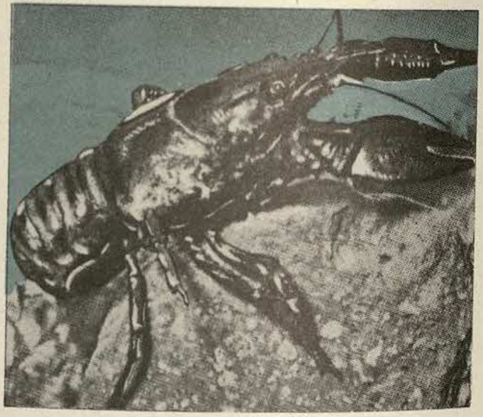
Two species are found in North America, the *sand-bill* and the *whooping* cranes There is a subspecies, the *little brown* crane. The largest is the whooping crane, which has a long, coiled windpipe which fits into the crevices of its breastbone. This windpipe may reach a length of eight feet, which gives the cry of the bird its peculiar "whooping" sound and the bird its name.

Cranes build their nests among the bushes at the side of a swamp and ordinarily lay two eggs. As a rule, they stand in the swamps at feeding time, early in the morning, often perching on one leg and dozing, with their heads drawn back against their shoulders. But let a fish or frog venture too close, and they are instantly awake.

The cranes in America are faced with extinction unless more adequate protection is provided for them. In Central Asia is the graceful *demoiselle* crane. Another type lives in Japan and India, where it is domesticated and held sacred by the natives.

CRA'NIAL NERVES. See NERVES.

CRAW'FISH, or CRAY'FISH. A common shellfish of fresh waters, the "craw daddy" resembles a little lobster. Any animal which a crawfish can get its claws on, dead or alive, it will start tucking into its mouth.



CRAWFISH—FRESH-WATER SCAVENGER

The crawfish inhabits fresh-water streams in North America, Asia, Europe, and England. It is highly prized as a food.

The mother crawfish carries her eggs and young around with her until the young can care for themselves. The young lay eggs of their own after they have become two years old, and they may live fifteen or more years after that.

Crawfish make excellent fish bait. In Europe they are eaten and considered very

THE CRANE IS A GRACEFUL BIRD

The crane, a long-legged, rather angular bird, lives principally in marshes and flooded areas. Although most of the cranes seem awkward, certain species, especially the *demoiselle* crane, are noted for their graceful movements.

good. A great deal of damage is sometimes done to levees and dams in the Mississippi Valley by the burrowing of crawfish.

Along the Florida Keys is found the *Florida* crawfish, or *sea roach,* a sea form fully equal in size to the northern lobster. The "sea crawfish" of the Pacific is properly the spiny lobster. See LOBSTER.

CRAY'ONS. Chalk, charcoal, pipe clay, and other materials are colored and molded into pencils to make crayons. The ordinary white crayon used in writing on school blackboards, although commonly called *chalk,* is not true chalk at all, but a manufactured product.

Pastel crayons are used in place of water colors to make the soft, delicately colored paintings which are popular. These crayons are composed of chalk and colors worked into a paste with "gum" water.

CREAM. Thick, rich, wholesome cream is milk into which a large amount of fat has been gathered from other parts of the original milk, as a flock of sheep scattered over twenty acres might be gathered on five acres. The gathering of the fat particles is done by the use of a cream separator or by allowing the milk to stand for some hours undisturbed in a pan or crock. In the latter case, the fat, being somewhat lighter than the liquid part of the milk, gradually rises to the surface.

Sometimes cream is thought of as a definite substance like water or vinegar. On the contrary, the fat may be gathered into a small amount of the original milk and give a very thick cream, or into a larger portion of the milk and result in thinner cream. Cream may contain anywhere from eighteen per cent of fat (that is, eighteen pounds of fat in each 100 pounds) up to forty or even fifty per cent of fat.

As sold at retail in cities, cream usually has eighteen to twenty-two pounds of fat to the hundred. Cream for shipping should have at least thirty per cent of fat. Cream containing forty or fifty per cent of fat is so thick it will scarcely run out of a can if cold.

The taste of fresh cream is pleasing to nearly every one and it has especially high value as human food. The fat supplies heat for the body and energy used by the muscles. The fat of cream, like that of other foods made from milk, such as butter and cheese, also contains Vitamin A. Without this vitamin found in milk and products made from milk, children or young animals cannot grow as they should.

In making butter, the cream is first separated from the milk and then churned. It is possible to make butter by churning the milk itself, but only a part of the butter churns out when this is done, and too much material has to be handled. In the making of ice cream, cream with about twenty per cent of fat is generally used. See BUTTER.

CREAM′ERY. In early days people in farm homes made their own butter. A few still churn butter for their own use, but nearly all butter on the market today is made in creameries.

Every creamery has an apparatus for testing the butterfat content of the milk or cream delivered there. It is on this basis that the farmer is paid, milk rich in butterfat being much more valuable than milk with a low content. Many creameries buy whole milk; and in such instances, tanks for holding the whole milk, the separated cream, and the skimmed milk are necessary. Other creameries buy only cream, the separating being done by the farmer, who feeds the skimmed milk to the calves and hogs on the farm.

In cases where the creamery buys whole milk, a gigantic separator operated by a gas or electric engine separates the milk and cream. The cream is then churned in enormous vats, and a production of about fifteen tons of butter daily is common in the largest creameries. An average-sized creamery can handle 10,000 pounds of whole milk every day. Buttermaking is in charge of skilled operators who have usually learned their trade at agricultural schools and colleges.

One of the outstanding methods of operating a creamery is the co-operative method. Under this system, farmers, working as a group, build, own, and operate a creamery, supplying it with whole milk produced on their farms. Profits are shared in proportion to the amount each farmer has invested.

Another method, somewhat similar, is the corporation method, where all farmers are stockholders and profits are paid according to the shares of stock owned.

The final plan is that of outright ownership by the operator of the creamery. He buys the milk or cream from the farmers and sells the butter himself, just as any other independent business man.

Besides skimmed milk, dried buttermilk is a useful by-product of the creamery. This is a fattening feed for chickens and livestock. See BUTTER; MILK; CREAM SEPARATOR.

CREAM SEP′ARATOR. The old-time method of placing milk in a pan, and leaving it undisturbed until the cream rose to the top, is the simplest process of separating cream. Today, on dairy farms and in creameries, a machine called the cream separator is used. The typical separator has

THE CHARGE AT CRECY, THE OPENING BATTLE OF THE HUNDRED YEARS' WAR

MAKING FARM WORK EASIER
Science relieved the farmer of a tedious task by the invention of the cream separator. It does the job more efficiently.

the following essential parts: the frame, the revolving bowl with its discs or blades, gearing for driving the bowl at a high speed, milk and cream collectors, inflow regulator, and the whole-milk reservoir. Mechanical power, usually an internal-combustion engine or electric motor, has replaced hand power for the larger machines.

Centrifugal force aids the separation of milk and cream while the milk is fresh. Milk, being heavier than cream, is thrown to the outer wall of the bowl when revolved at high speed. The bowl, which is the principal part of the machine, varies in size from one holding two quarts when the discs or blades are removed to those holding several gallons.

The centrifugal separator has the following advantages over the former methods: (1) More complete separation is obtained; (2) it is possible to regulate thickness of cream; (3) the cream is obtained fresh; (4) much time and labor are saved; (5) fresh skimmed milk is available for stock; (6) certain impurities are removed from the milk. See BUTTER; CENTRIFUGAL FORCE.

CRÉCY, *kra se',* FRANCE. A town in Northern France, Crécy is of no industrial importance. But what it lacks in industry, it makes up in historical interest. For it was there that the first great battle of the Hundred Years' War between England and France was fought, August 26, 1346.

An invading English army under Edward III defeated the French army under Philip VI. The battle was one of the bloodiest ever fought, for 30,000 of the French were killed, including King John of Bohemia and many other great nobles. It was at Crécy, too, that the famed English Black Prince gained his prominence. This battle was one of the first in which gunpowder was used. In this battle, too, it was proved that the English yeoman with his longbow was the superior of the armor-clad French knight. See BOW.

CREDIT. The basis of most business transactions is credit based on confidence between the debtor and creditor. This confidence may be either of two kinds—trust in the honor and ability of the debtor to pay, or faith in the security deposited by the debtor to cover the debt. Both may be necessary before a credit transaction can be completed. Probably the commonest form of credit is that found in the *charge system,* in which a customer may buy goods and pay for them later.

Instruments of Credit. Most important credit transactions are accompanied by an instrument of credit, a document showing that the debtor owes the creditor a certain sum. The usual forms are notes, bills, mortgages, and bonds. When one borrows money from a bank or other source, he signs a note promising to repay the amount with interest on a certain date. If a large sum of money or credit is required, *collateral*—which may be real estate or insurance, stocks or bonds, or some other asset—is deposited to secure the note. In the event of non-payment, the collateral is forfeited, becoming the property of the institution granting the loan. A common practice of large business organizations is to mortgage all or some of the company's assets. In the case of railroads, their "rolling stock," that is, locomotives and railroad cars, are the collateral for the mortgage (see BOND).

Credit transactions have greatly increased in recent years, due in part to laws giving the creditor or lender greater protection. Higher ethical standards of the people, who usually make an honest effort to repay borrowed money, has also been an important factor in the increase of credit.

The Advantages of Credit. The chief advantage of credit is that people who are at the moment unable to pay cash may purchase goods and pay later, thus keeping the mills and factories of the nation busy. At the same time, it gives the debtor the use of the goods.

Credit also puts money to work. Instead of hiding away a few dollars not in actual use, people now deposit it in banks, and the banks lend the money to people who need it. For the use of this money, the depositor is paid a small rate of interest, the borrower profits, and the bank makes a profit. See BANKS AND BANKING.

Public Credit. When a nation, state, county, or city needs money immediately, it issues bonds which are sold to investors. These bonds are actually promissory notes and carry a low rate of interest, chiefly because the investor has confidence in the ability of the government to repay the money at the specified time. Government credit or public credit is unusually strong because all the property of the nation or state is back of the loan as security.

CRE'DIT MOBILIER, *mo beel' yur,* **OF AMERICA.** In 1863, in Pennsylvania, there was organized a joint-stock company with a capital of $2,500,000. It was known as the Crédit Mobilier of America. Four years later the charter was sold to another company for the purpose of constructing the Union Pacific Railway. Enormous rights and profits were expected. Little attention, however, would have been paid to this fact alone, had it not been that in 1872

CREE FAMILY GROUP WITH NATIVE TRAVOIS

The Cree Indians, at one time the most powerful of the Algonquian tribes, originally occupied large portions of Saskatchewan and Manitoba. The travois is a native device on which the family's goods could be moved from place to place as the tribe migrated.

a great scandal broke out in connection with the affair.

Congressional investigation disclosed that the Vice-President of the United States, the Secretary of War, the Speaker of the House, and several members of Congress were secret stockholders in the concern. It was charged that these men received their stock and other bribes in exchange for legislative favors conferred on the company.

The Secretary of War resigned under threat of impeachment. The whole affair, after a time, finally died out, and the railroad was eventually built.

CREE. A part of the great Indian nation of Algonquians, the Crees were once one of the largest and strongest of Indian tribes in America. Their home was in Canada, where they occupied large parts of what is now Manitoba and Saskatchewan. A short time after the English and French began to colonize Canada, the Crees sold their lands to the Canadian government.

CREEKS. With the exception of the Cherokees, the Creeks were at one time the largest and strongest Indian tribe south of New York. Numbering about 30,000, they lived in Georgia and Alabama. Unlike most Indians, they lived in log houses.

During the American Revolution, the Creeks aided the British. In the War of 1812 some of them raided and massacred American settlers at Fort Mims. Two years later they were defeated by the colonists in a battle at Horseshoe Bend. They were stubborn and refused to leave their land until driven out. They likewise refused all attempts of the colonists to educate them.

Finally they were transferred to Indian reservations in Oklahoma, where they have become American citizens. The land on which they were settled was later found to be rich in oil, and many of the Creeks have become immensely wealthy. The present number of Creeks is estimated to be over 9,000. See FIVE CIVILIZED TRIBES.

BARK INSPECTOR

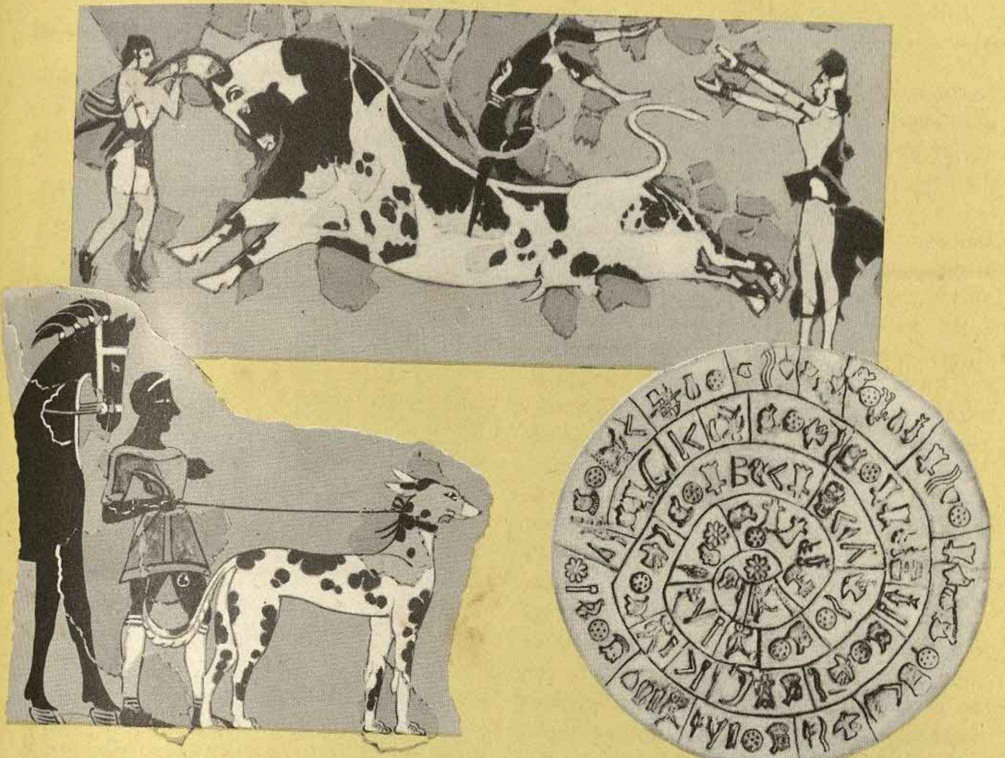
CREEPER. Closely related to the nuthatch is the brown creeper, a small bird that inhabits Eastern North America, breeding in Northern New England and Minnesota southward. In winter it is found throughout the country generally. About five inches long, the brown creeper has brown-streaked feathers, white and buff above, and white or brownish white below. The slender bill is somewhat curved, and the stiff tail feathers are sharply pointed and are used in climbing, as are those of the woodpeckers.

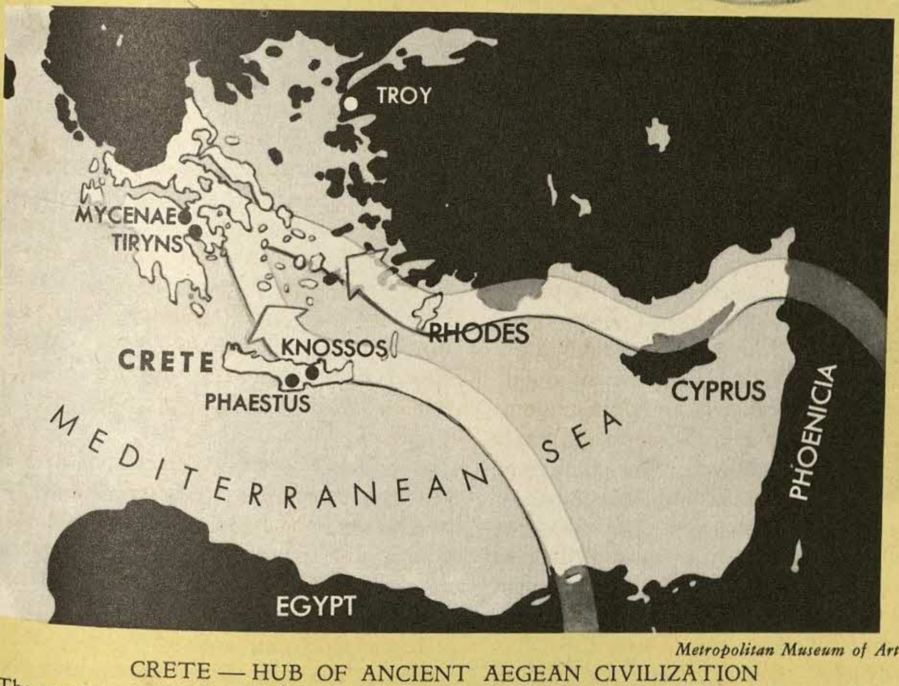
The brown creeper seems to be always on the move. It has the habit of starting at the base of a tree and creeping upward round and round until it can go no farther, when, without a pause, it drops quickly to the base of the next tree and repeats the climb. Its food is mostly made up of small insects and insect eggs, with a few seeds. It renders good service to man, finding many pests that other birds overlook.

CREOLE, *kre′ole*. Descendants of Spanish, French, and Portuguese born in the West Indies and in the southern part of the United States are known as Creoles. When properly used, the term applies to pure-blooded white descendants and not to mulattoes.

CRE′OSOTE. Discovered by Karl von Reichenbach in 1832, creosote could at that time be obtained from wood tar only after a long and tedious process. Today it is manufactured in large quantities by the destructive distillation of both wood and coal tar. See COAL TAR.

Creosote is an oily substance having a burning taste and a decidedly smoky smell. Although colorless when pure, it usually has a brownish color in the commercial





Metropolitan Museum of Art

CRETE — HUB OF ANCIENT AEGEAN CIVILIZATION

The movement of cultural influences from western Asia and North Africa to the Greek mainland is traced on the map above. As a crossroads of travel and trade, Crete played a major role in this development of civilizations in the ancient world. At the top of the page are examples of Aegean art and, on the circular plate, of writing in the form of pictographs. These date from centuries before the Christian Era.

form. Beech wood in particular yields creosote extensively when distilled. Chemically, creosote consists of a mixture of phenols and their ethers.

Creosote is used extensively as an antiseptic in dentistry and surgery and is useful as a deodorizer (remover of odors). It has also been much used in the treatment of tuberculosis. But its use as a medicine should always be directed by a physician.

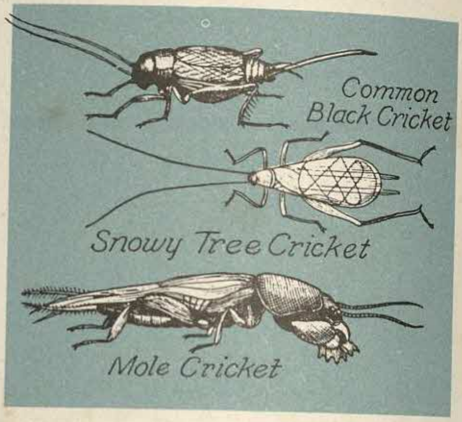
Coal-tar creosote is technically known as *creosote oil* and is used largely for the preservative treatment of timber and posts. It may also be used as a fuel and in the treatment of certain diseases of cattle and sheep. Creosote is only slightly soluble in water, but is readily soluble in alcohol or ether.

CRETE, *kreet.* An island near Greece in the eastern Mediterranean, Crete has an area of but 3,199 square miles. It is about 160 miles long and from seven to thirty-five miles in width. The population is about 450,000. Canea, the capital, has a population of approximately 26,600.

Manufacturing and trade are of little importance in Crete, and the entire population makes its living by farming. The chief products and exports of the island are wool, wine, oil, grain, and some fish. The island, as a whole, is of little importance commercially.

According to Greek mythology, Zeus, Saturn, and Minos were all rulers of Crete. The earliest actual knowledge of the island is that it was once a republic and the headquarters of the Sicilian pirates until they were driven out by the Romans. Rome lost it to the Saracens in 823, who held it until the Greeks again conquered it forty years later. In 1204 it was sold to the Venetians, who lost it to the Turks in the latter half of the seventeenth century, after a siege of the capital that lasted for more than twenty years. Under the rule of the sultan the people were dissatisfied, and there were numerous revolts.

Greece regained the island in 1913. In 1935, it was the birthplace of the revolution led by Venizelos, who became Prime Minister of Greece. In 1941. when Greece fell to the Germans, its government fled briefly to Crete; but the island also fell and was held by the Germans during World War II.



THREE GAY CHIRPERS
Crickets make a merry chorus in the woods.

CRICK'ET. To most of us the chirp of a cricket is a cheery sound, and in many households this "singing" insect is a regular visitor at the chimneyside when cold weather approaches. Crickets are related to the grasshoppers, and like them are furnished with hind legs fitted for jumping. The antennae, or feelers, of the cricket are longer than the body, excepting in the mole crickets; and the wings of the crickets are carried flat on the top of the body rather than at the sides, although the edges are generally bent down along the sides. Most female crickets have long spearlike egg-laying organs, and male crickets usually have more or less prominent, rather thickened tail-like appendages.

The crickets with which we are most familiar are the common *black* crickets found on the ground under any kind of shelter, usually in moist places, sometimes in houses, where they may injure vegetables stored in cellars and have been known to damage clothing.

The well-known song of the male black cricket is made by rubbing the wings over each other. There are specially roughened spots near the base of the wings which produce the sound.

Less frequently seen are the slender-bodied, yellowish-white *tree* crickets. Late in the fall these may be seen in numbers on the trunks of trees, especially maples, in the daytime. Otherwise they are strictly night insects and are seen in the daytime only if special search is made. They lay eggs in the wood of fruit trees and brambles and do some injury in this way.

Mole crickets live in the ground in moist places and are occasionally found around lights. Usually they are plowed out, or discovered when stones are turned over in damp fields. A collector with keen hearing can locate the mole crickets by the noise they make, even while they are in their burrows. A mole cricket is much different from the other crickets. Its front feet are short and shaped like those of a mole, being adapted for the same purpose, digging. The front wings are short, but the hind wings are rather large and capable of flight.

ENGLAND'S NATIONAL GAME

Cricket, a distant relative of baseball, is played with two *wickets* (left), a hard wood ball, and a flat *bat*. Here an expert demonstrates the ideal batsman's "stance" in playing.

CRICKET. England's national game, cricket, is as popular on the playing fields of the British Isles as baseball is in the United States. Like baseball, cricket is played with a *ball* and *bat*, but instead of nine men, the team consists of eleven, and instead of home plate and three bases, there are two *wickets*. As a matter of fact, the game of baseball is said to have developed from cricket.

The game is played between two teams of eleven men each, on a level grass *field*. The bat used is not over thirty-eight inches long and four and one-fourth inches wide. The ball is three inches in diameter and weighs five and one-half ounces. In the center of the field are two wickets twenty-two yards apart. Each is composed of three sticks twenty-seven inches high, covered with two light wooden *bails,* or crosspieces.

The team at bat sends in two men, one in front of each wicket. The team in the field sends in one man as *bowler* and spreads the other ten over the field as desired. From a point beyond eight feet eight inches from the wicket, the bowler bowls the ball to the *batter* (who protects his wicket and must be within four feet of it). The batter hits a selected ball and starts for the other wicket, exchanging wickets with his team mate. The team in the field recovers the ball and tries to hit either wicket (thereby hitting off the bails) to score an *out.*

A *run* is scored every time the runners cross each other. Two new players of the side at bat take their posts at the wickets after each out, until ten of them have done this. The teams then change *innings,* but any number may be arranged. Besides hitting down the bails, catching a *fly ball* may score an out. With the exception of the *batsmen* and the *wicket keeper,* the players use no gloves.

In cricket, skill in hitting a moving object is developed, rather than strength. Quick thinking, running, and acting are the qualities each player should have. The game of cricket is not strenuous and is, therefore, suitable for both sexes at all ages.

CRIME. Squad cars, short-wave radios, lie detectors, and many other modern devices are used today by police in an effort to catch the wary criminal. Such devices have been developed in an effort to cut down the enormous crime bill that the people of the United States are required to pay each year. Never has crime been so widespread as it is today. Since the World War, with our changed social conditions, crime has constantly increased. The loss of property and the cost of law enforcement in the United States amount to more than fifteen billion dollars annually.

Although minor crimes have greatly increased in recent years, it is organized crime, carried on by powerful gangs, that has taken the largest toll of life and property. The practice known as "racketeering," carried on by these gangs, is often accompanied by violence and takes many forms. Merchants are forced to join "associations" and pay heavy dues for "protection." Wealthy people are kidnapped and held for huge ransoms. Racketeering was at its height during the prohibition period, when so-called "beer barons" shipped and sold liquor despite the laws against it.

Along with racketeering and gang warfare, the large number of bank robberies, murders, and crimes of lesser importance has given the United States the reputation of being one of the most lawless nations in the world. The million and more serious crimes committed each year can largely be traced to the poor and crowded sections of large cities; there, under-privileged children first commit minor crimes in order to get what they need, and later become members of criminal gangs. Records show that twenty per cent of all crimes are committed by youths under twenty-one years of age.

In an effort to cut down the crime rate, cities have undertaken intensive campaigns to wipe out the racketeering gangs. Social organizations are attempting to prevent crime through education and by giving the youth of slum districts a healthful environment. The Federal government is carrying on a program of law enforcement and crime prevention through the Department of Investigation. The members of this department, commonly known as the "G" men, have been highly successful in bringing criminals to justice. The "G" men are experts in the use of scientific instruments and methods of identifying bullets, firearms, and fingerprints.

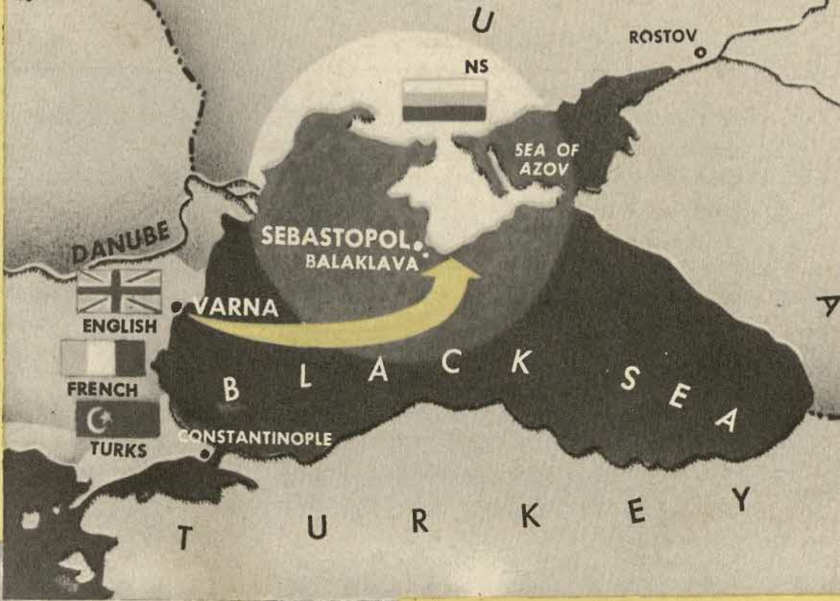
According to the laws of the United States, there are three types of crime: *treason,* a crime against the nation; *felony,* a crime punishable by death, or imprisonment in a state penitentiary for more than one year; and *misdemeanor,* a minor crime punishable by a fine, or a short term of imprisonment, or both.

CRIME'A. The historic Crimean peninsula has been a center of invasion and conquest for many centuries. Covering an area of 15,060 square miles, it lies in Southern Russia between the Sea of Azov and the Black Sea, and is joined to the mainland by the Isthmus of Perekop. A canal has been built across the isthmus, making the peninsula an island.

The Crimea was settled in ancient times by the Cimmerians and somewhat later by the Greeks. When the Romans conquered this part of the world, the Crimea fell into their hands only to be lost to the Mongols during their invasion under Genghis Khan, in 1237. The place again changed hands when the Genoese fortified Kaffa in 1261 and extended their influence over the whole area.

In 1475 the Turks, under Mahomet II made the land a part of the Turkish Empire. Finally it was regained by the Russians in 1783, and to discourage any further invasions on the part of the Turks, Catharine II ordered a great arsenal built at Sebastopol. The military power of the region was steadily increased until it fell into the hands of the French in 1855. It was held but two years, however, before it was again returned to the Russians. See CRIMEAN WAR.

Following World War I, the Crimea in 1921 declared its independence and set up a republic. Later it was united to Soviet Russia. During World War II, the Germans attempted to gain control of this strategic region; but the Russians finally broke the long siege of Sebastopol and regained the Crimea.



U. S. Signal Corps Photo

HISTORY AND THE CRIMEA

The map above shows the route by which 57,000 British, French, and Turkish servicemen were shipped from the west coast of the Black Sea to the Crimea during the Crimean War. This troop movement, in 1854, made military history. At left is shown the final defeat of the Russians at Sebastopol. Below are Prime Minister Churchill of Great Britain, President Franklin D. Roosevelt of the United States, and Marshal Joseph Stalin of the Soviet Union at the Crimean Conference, held at Yalta a few months before the end of World War II.

The Crimea is one of the most fertile regions of Russia. Olives, grapes, and mulberries flourish in the southern mountain valleys, while on the steppes, farther north, tobacco, hemp, flax, sheep, cattle, and horses are raised. The chief town and port of the area is Sebastopol, which has a population of 148,000.

CRIMEAN WAR. A desire on the part of Russia to extend her power at the expense of Turkey brought about the Crimean War. Lasting from 1854 to 1856, the war was fought for the most part in the Crimea, a peninsula of Southern Russia (see CRIMEA).

Russia fought alone, but Turkey had as allies England, France, and Sardinia. Important among the battles fought were those of Alma, Sebastopol, Balaklava, and Inkermann. It was at the Battle of Balaklava that the famous, but tragic, "Charge of the Light Brigade" occurred. The Battle of Sebastopol, ending in victory for the allies after a long siege, brought the war to a close. By the treaty of peace, signed at Paris in March, 1856, the independence of the Turkish Empire was guaranteed. See CHARGE OF THE LIGHT BRIGADE.

TRAP OF THE SEA

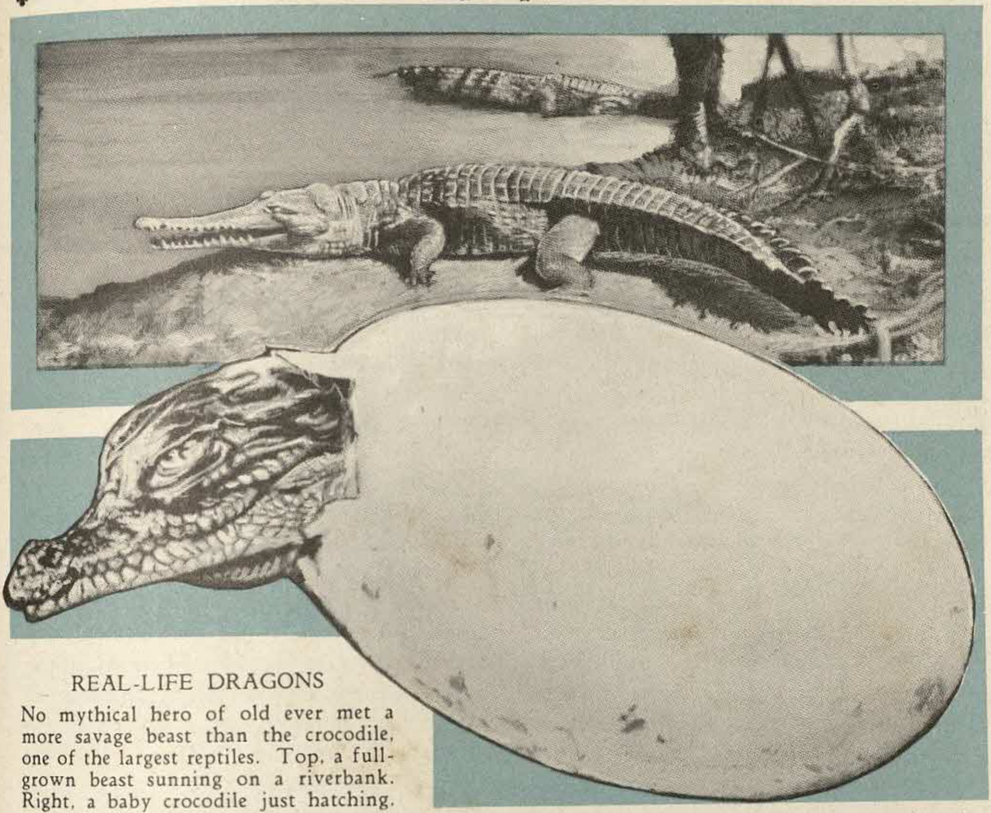
These waving tentacles surround the mouth of a species of Crinoidea, and any food that floats too near will be seized and devoured instantly.

CRINOIDEA, *kri noi'de ah,* **or SEA LILIES.** Although they have the appearance of flowers, Crinoidea, or sea lilies, are animals. Their flower-like appearance is due to their long, hard stems with the circle of feather-like arms. In the centers of these "flowers" are mouths for gathering food from the water. These animals attach themselves by their stems to rocks at the bottom of the sea.

Formerly the Crinoidea were very numerous, but they have almost entirely disappeared. Traces of them may be found, however, in limestone formations, where pieces of their stems have turned to limestone and broken into circular sections. Crinoidea are related to starfishes.

CRIT'TENDEN COMPROMISE. In 1860, Senator John Jordan Crittenden of Kentucky introduced into the senate an amendment to the Constitution which was to be known as the Crittenden Compromise. It was one of the desperate efforts of members of Congress to avert a civil war in America. Under its provisions, the Union was to be divided into two sections, one free and one slave. The dividing line was to be latitude 36° 30′. The Federal government, under its provisions, would not have the power to abolish slavery in the District of Columbia, or in a slave state. Neither would it have the power to prohibit the slave trade. The bill failed to pass both houses of Congress.

CROATIA, *kroh a' shih uh,* **and SLAVONIA,** *sluh vo' nih uh,* before World War I were a crownland of Austria-Hungary. After the war, the region was a province of Yugoslavia. In 1946, it became the republic of Croatia, one of the six federated republics of the Republic of Yugoslavia. This republic is in northwest Yugoslavia, and Slavonia is the eastern part of it. The republic has about 21,714 square miles and a population of 3,919,000. It and other Yugoslavian territory was made into an Italian-dominated kingdom of Croatia by the Axis powers during World War II, but the Allies won it in 1945. See YUGOSLAVIA.



REAL-LIFE DRAGONS

No mythical hero of old ever met a more savage beast than the crocodile, one of the largest reptiles. Top, a full-grown beast sunning on a riverbank. Right, a baby crocodile just hatching.

CROCK'ETT, DAVID (1787-1836). One of the great pioneer heroes in American history is David Crockett. He was born in Tennessee, and his training was what he gathered from the wild frontier of the time. He was poorly educated, but what he lacked in education he possessed in wit, cleverness, and hunting skill. While still a young man, he took an active part in wars against the Indians, serving under General Andrew Jackson against the Creeks.

Following the Indian wars, he served three terms in Congress, gaining notoriety by his backwoods garb. Always an active man, he retired from Congress and aided the Texans in their struggle for independence from Mexico. He lost his life at the famous Battle of the Alamo in 1836 (see ALAMO).

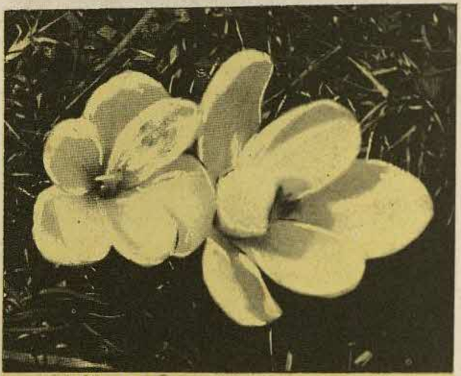
During the course of his lifetime, he published several books, among them *A Narrative of the Life of David Crockett, A Tour to the North and Down East,* and *Exploits and Adventures in Texas.* All these books were poorly and crudely written. Yet they were full of sound common sense, a quality typical of rough-and-ready David Crockett.

CROCODILE, *krok'o dile.* This ugly and fierce-looking reptile greatly resembles the alligator, and likewise inhabits swampy and marshy regions. It differs from the alligator, however, in that it is more active and has a much narrower head. It also has longer and more pointed teeth. Despite its appearance, the crocodile fears man and will not attack except when forced to fight.

Crocodiles are rare in the American continent north of Mexico. A few have been found in Southern Florida. South of the United States, the American crocodile occurs from Mexico to Ecuador and in the West Indies. The dangerous "man eaters" are not found in America, but live in India and Africa.

The eggs are hard-shelled and each is about three and one-half inches long and two inches in thickness. One female may lay thirty or more eggs.

The skin and flesh are valuable commercially, the skin making a very tough leather. The flesh is edible. See ALLIGATOR.



GAY HARBINGER OF SPRING

In most temperate regions, the crocus is the first flower to bloom. Sometimes it thrusts its bright blossom up through the snowdrifts.

CROCUS, *kro'kus.* When we see the first crocus blooming in the garden, then we know that spring is really coming and soon other flowers will bloom and fill the world with color.

Glad as the spring when the first crocus comes
To laugh amid the shower.

The crocus is yellow, purple, pure white, or white striped with purple. It opens only in the sunshine, and its chief charm is, of course, that it comes so early. Therefore, plant the bulbs in a sunny spot so that they may come into bloom as early as possible. The bulbs are best planted as soon as they can be purchased in the fall, because they should not be allowed to remain out of the soil for any length of time. Plant the bulbs about one and one-half inches deep.

The *autumn* crocus, instead of blooming in the spring, blooms in September or October. The flowers are usually lilac-colored. The leaves, which are large and broad, are produced in the spring, and the flowers then develop in the autumn without foliage. The autumn crocus blooms whether in soil or in water. It is interesting to have a few of these bulbs in dishes indoors where they may be forced in late summer.

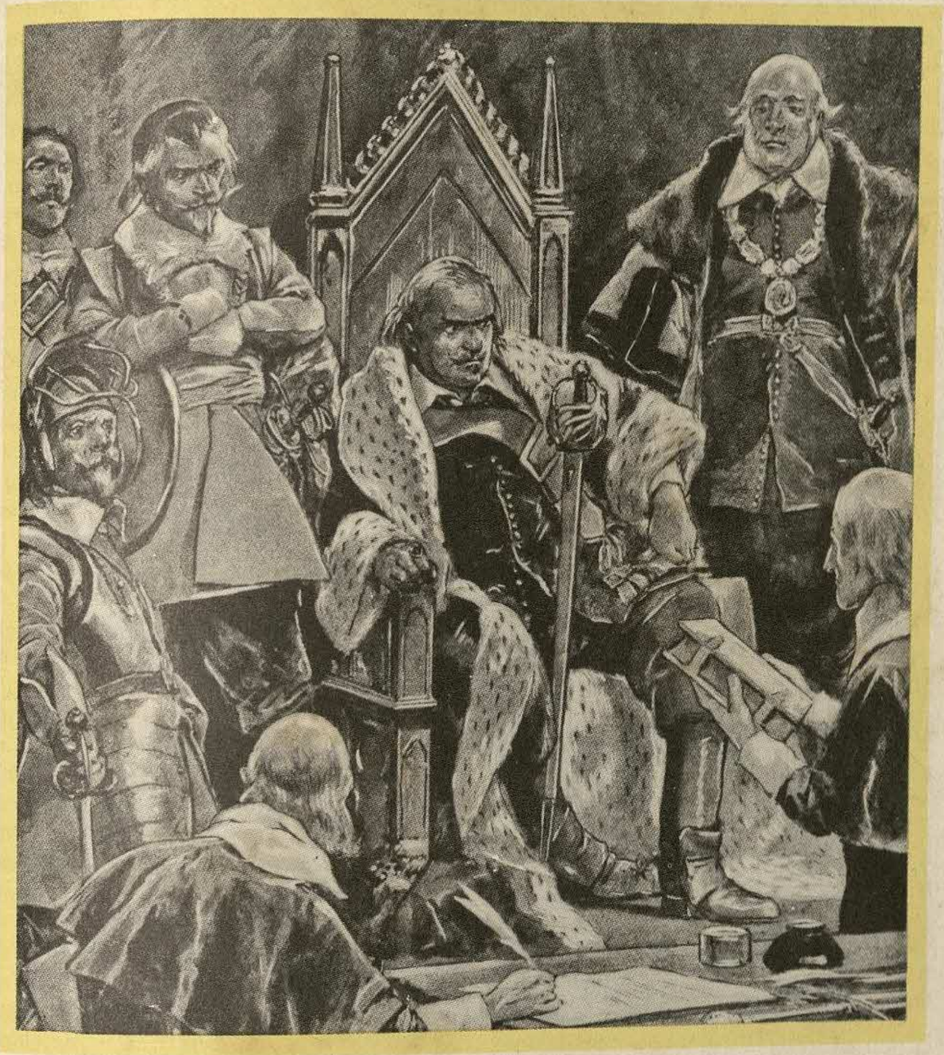
CROESUS, *kre'sus.* Almost everyone has heard the expression "as rich as Croesus." His great fortune, from the mines of his kingdom and from the gold dust of the Pactolus River, was greater than that of any king before his time. He was the last of the rulers of the kingdom of Lydia, where he reigned in the sixth century B.C. He ruled but fourteen years when his kingdom was conquered by the Persians under Cyrus the Great.

CROM'WELL, OLIVER (1599-1658). Except for one brief period in the seventeenth century, England has been ruled by kings. Only one man in the 900 years since the Normans conquered the land has ever taken the place of a Plantagenet, Lancaster, Tudor, Stuart, or Windsor. That man was Oliver Cromwell, a Puritan commoner, a pious and brilliant soldier who renounced the title of king to be Lord Protector.

Cromwell was born in 1599 at Huntingdon, at the close of a brilliant era in English history. Queen Elizabeth was still on the throne; but, four years later she was dead, and the turbulent but wise reign of the Tudors was ended. During his youth, when he attended Cambridge University, James I, first of the Stuarts, was on the throne, and the strife between monarch and Parliament that was to end in civil war became steadily more and more bitter.

In 1628, three years after James died, Cromwell was elected to Parliament. By this time the struggle between Parliament and the Stuarts centered around religion. Cromwell, as a Puritan and a cousin of the non-conformist, John Hampden, naturally opposed the wasteful, indulgent Charles I, who succeeded James. Finally, in 1642, war broke out between Parliament and the king. On the surface, the struggle was between the pious Puritans of Parliament and the extravagant Charles. Actually, it was a contest between the monarchy and the Parliament for power.

Cromwell organized a troop of cavalry and distinguished himself at Edgehill. He controlled the eastern part of England and in 1645 became the leader of the Parliamen-



ENGLAND GETS A RULER WHO IS NOT A KING

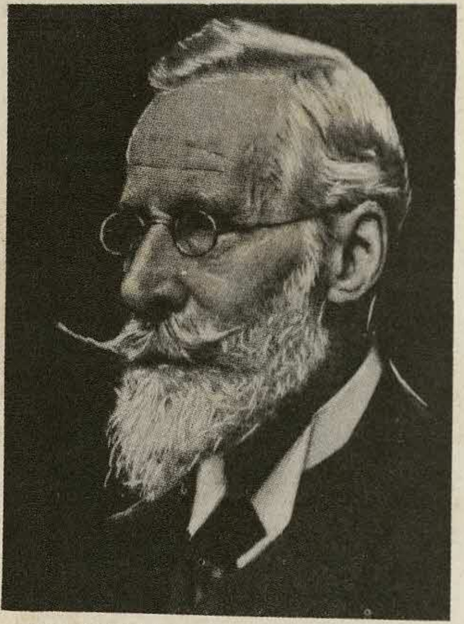
In 1653, for the first time in English history, a commoner governed Britons. He was Oliver Cromwell, here shown taking the oath of office. He was declared Lord Protector after the execution of King Charles I. A dictator, Cromwell ranks among England's great men.

tary army. Four years later he was victorious, and Charles I was beheaded, an act that shook the throne of every ruler in Europe.

Cromwell became Lord Protector of the newly formed Commonwealth and put down revolts in Scotland and Ireland. Although the execution of a tyrannical king was the handwriting on the wall for other European monarchs who made England an outcast, Cromwell restored his country to a dignity that won the respect of the world. He was offered the throne but declined, content to rule as dictator, resting his power on his well-trained army. Although he called Parliament into session several times, popular rule failed.

Cromwell's years in power were troublous not only at home but abroad. He aided France and Spain in wars, went to war against Spain once, won Jamaica for England, and engaged in other struggles. But the ordeal of warfare exhausted his strength, and he died in 1658.

Always devoutly religious, Cromwell had visions of becoming the head of a league of Protestant nations. He expected his son Richard to succeed him as Lord Protector; but in less than a year Richard, unsuited to the high office, resigned. In 1660, England welcomed Charles II to the throne. See COMMONWEALTH OF ENGLAND.



HE MADE THE X-RAY POSSIBLE
Sir William Crookes was the English physicist who invented the Crookes tube, a vacuum bulb in which electric discharges cause X-rays.

CROOKES, WILLIAM, Sir (1832-1919). Industrial chemistry, a science that has opened innumerable pursuits to modern commerce, owes much to Sir William Crookes, an English scientist who specialized in this field. Not only did he find a new method of extracting gold and silver from their ores by the sodium amalgam process, but he was one of the first to use the spectroscope in determining the makeup of substances.

Born in London, Crookes was educated at the Royal College of Chemistry, later becoming associated with the Radcliffe Observatory of Oxford University, as meteorologist. Following this association, he joined the faculty of Chester Training College as a professor of chemistry (1855), where he developed many of his formulas for applying chemistry to industry and sanitation. One of his most important investigations was that in connection with the Crookes tube, an electrical device used in making X-ray apparatus (see CROOKES TUBES). He also gained renown as the discoverer of the element thallium. Crookes received half of the Nobel Prize in Chemistry in 1907, sharing it with Eduard Buchner of Germany. He had been knighted ten years previously.

He wrote a number of books, including *Select Methods of Chemical Analysis, A Solution of the Sewage Question, The Wheat Problem,* and *The Profitable Disposal of Sewage.*

CROOKES TUBES. The English scientist, Sir William Crookes, devoted much time and study to certain effects produced in glass vacuum tubes that have been called Crookes tubes in his honor. A Crookes tube is one from which the air has been pumped and into the opposite ends of which metal electrodes have been sealed. The positive electrode is the anode, the negative is the cathode.

When these terminals have been connected with a source of high electrical power, a greenish glow, or fluorescence, appears on the wall opposite the cathode, and a metal target placed in front of the cathode throws a shadow on the fluorescence. These effects are due to the emission of so-called cathode rays from the negative terminal. They are known to be streams of electrified particles, or electrons. Crookes tubes are used in the production of Roentgen rays (X-rays). See CATHODE RAYS; ROENTGEN RAYS.

CROSS. Ever since the Crucifixion of Christ, the cross has been one of the world's most cherished symbols. Representing

Christianity in general and the Catholic Church in particular, the cross was worn on armor and emblazoned on banners carried by the Crusaders against the infidel Turks in the Holy Land. Through the centuries it has been carried by stout-hearted missionaries into all countries. The cross surmounting the spire of church, cathedral, hospital, or school tells that the Christian faith is honored in the work being carried on.

Up to the time of the Crucifixion, the cross was a symbol of punishment, and on it all criminals of the worst type were executed. The crosses of this type were formed by fastening a crosspiece on an upright post or tree.

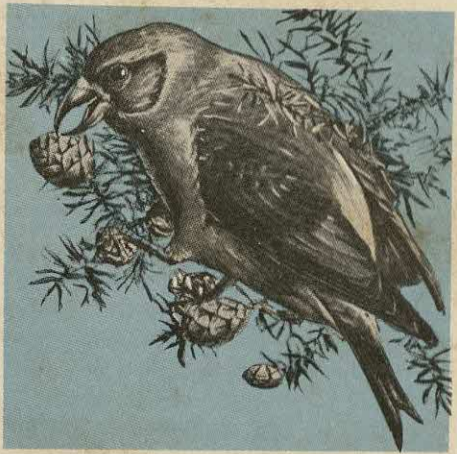
There are four leading types of crosses. Chief among these is the Latin cross, similar to the one on which Christ died. It is formed by fastening a crosspiece at right angles to an upright.

The Greek cross is similar to the Latin, but all arms of the cross are of about the same length. This is the type used as the symbol of the American Red Cross and the cross of Saint George of England. The Saint Andrew's cross is much like the Greek, but the arms intersect obliquely, making an X-shaped cross.

Still another well-known cross is the Maltese, which closely resembles four fish tails fitted together. Each of the arms of this cross has two points, making the entire cross somewhat like a star.

CROSS'BILL. This small bird of the finch family is easily recognized by its strange beak, resembling a pair of scissors. Legend says that the bird received its peculiar bill from attempting to pull the nails from the hands of Jesus when He was crucified, and the story has been beautifully told in Longfellow's translation, *The Legend of the Crossbill.* It is well known that the crossbills use their bills very skillfully in opening the cones of pine, spruce, and hemlock trees to get the seeds.

There are two crossbills in North America, the *red,* or *American,* being more common than the *white-winged* crossbill. Both nest in the evergreen forests of Canada, and the red species is found also in Northern United States. They are plump birds about six and a quarter inches in length. The male red crossbill is dull red with dark wings and tail, while the white-winged male is a rosy red with black wings and tail. Females are olive-colored.



THE BIRD WITH A SCISSORS BEAK
Crossbill's beaks are used to open cones.

The eggs are pale green in color and the nest is made of twigs, rootlets, bark, grass, moss, and hair. Crossbills have a pleasing song, but one not especially notable.

CROSSBOW. See Bow.

CROSS-FERTILIZATION. A majority of the plants that grow in our fields and woods are the result of cross-fertilization. In reproduction by this method, the *pollen* from the *stamens* of one flower is transferred to the *stigma* of the *pistil* of another. In this process, the pollen may be carried by insects or the wind. Plants such as clover and fruit trees have showy blossoms and nectar that attract bees and other insects, and these spread the pollen.

Corn is an example of cross-fertilization by wind, since it produces great quantities of pollen from the *tassels,* to be carried by the wind to the *silks* of other corn plants. In some cases, pollen is carried by nectar-sucking birds such as the humming bird, and in others the pollen is wafted from one place to another on the surface of water.

CRO'TON AQUEDUCT, *ak'we dukt.* New York City, requiring more than a billion gallons of water a day to satisfy its needs, depends upon the Croton aqueduct for a part of its water supply. Actually, there are two aqueducts leading from Croton Lake. The first, completed in 1842, is thirty-eight miles long and furnishes seventy-two million gallons a day. The second, thirty-one miles long, provides 300 million gallons. Since neither furnishes enough water for the city's growing population, additional reservoirs and aqueducts have been constructed. See Aqueduct.

CLEVER PEST
Crows are a bug, crop menace.

CROW. Intelligent and shrewd, this large, black bird has defied all efforts of man to destroy it. Not only has the crow a bad reputation among farmers, whom it robs of corn, but it also destroys the eggs and young of small birds. The crow, however, is not without some good qualities. It is useful because of its habit of eating cutworms, white grubs, grasshoppers, and other injurious insects.

The common, or American, crow, which averages nineteen inches in length, is found in most parts of North America; the crows in Canada move southward into the United States in winter. It is at this season that they flock together, in some cases by hundreds of thousands, to roost at night, scattering during the day to search for food. Anyone who has lived close to a crow roost is not likely to forget it.

THRONELESS PRINCESS
This is the daughter of a chief of the Crow Indian tribe. Although Indian royalty is no longer powerful, it is socially important.

In the breeding season, crows are more scattered, each pair building a nest apart from others of its kind. The nest is a bulky one of sticks, weed stalks, cornstalks, and the like, with a softer inner lining, placed from four to a hundred feet up in a tree. There are usually from three to six green eggs thickly marked with brown. The crow has no song, but can mean a great many different things with its familiar *caw, caw*. A young crow can be tamed quite easily and makes an interesting though mischievous pet. It can be taught to say a few words of the human tongue.

Recently, crows have been killed for food, but crow's meat as an article of diet has not yet been widely adopted. See Raven.

CROW. A strong, fierce tribe of Indians, the Crows formerly lived in Southern Montana and Wyoming. They were divided into two groups, the Mountain Crows of Southern Montana and the River Crows, who camped along the Yellowstone River.

The braves of this tribe were almost constantly at war with their Indian neighbors, especially the Sioux. However, they maintained peace with the whites, and often served the pioneers as guides and scouts in the settlement of that part of the country.

The great Crow nation, of which only about 2,250 remain, has now been gathered on a reservation near Lodge Grass, Mont.

NOISY BIRD CITIZEN
The crow blackbird's voice is creaky but loud.

CROW BLACKBIRD, or PURPLE GRACKLE. The largest members of the blackbird family, the grackles have dark metallic plumage, yellow eyes, and long, fan-shaped tails. The two most common species are the *purple* and the *bronzed* grackles. The purple, which is the larger, is found east of the Alleghenies from Georgia to Massachusetts and in the lower Mississippi Valley. Grackles spend much of their time on the ground, where they walk with an awkward waddling gait, solemnly turning their heads this way and that, as the sun reflects the luminous, metallic hues of their plumage.

CROWN. One of the best-known coins of England is the crown. It is equal to five shillings in English money and, normally, about $1.22 in American money. On one side is imprinted a crown; on the other is a picture of the ruling sovereign. Crowns were formerly made of gold, but since 1551 have been made of silver. The weight of a crown is 436.3636 troy grains, of which about 414 grains are silver. The name is used for the monetary unit in various other countries; for example, there are the Danish and Norwegian *krones,* the Estonian *kroon,* and the Swedish *krona.*

CROWN. Though the crown as worn by kings of today is a symbol of royalty, such has not always been the case. The earliest known crowns were merely garlands of leaves placed on the heads of winning athletes. Later, the Romans awarded crowns to military heroes. A crown of oak leaves went to the soldier who saved the life of a Roman, a crown of grass and flowers to the general who conquered a city, a small gold crown to the soldier who first scaled the wall of a city under attack, and a special naval crown for Roman heroes of naval engagements.

One of the most famous and most interesting crowns of Europe is the Iron Crown of Lombardy, which was worn by the Lombard kings. It is now a priceless relic of the Church of Saint John the Baptist, at Monza, Italy. Made of gold and set with precious stones, this crown owes its name to an iron band on the inside, said to have been made from one of the nails of the cross on which Christ died. Napoleon wore the Iron Crown at his coronation in 1805.

About the middle of the nineteenth century, workmen digging near Toledo, Spain, uncovered eight gold crowns of the seventh century which were purchased by the Cluny Museum in Paris for 4,000 pounds. The gold in the crowns was easily worth 600 pounds, and they were heavily encrusted with precious stones.

The crown jewels of England are said to be valued at over $1,000,000. Crowns of rulers are usually worn only on great and solemn state occasions. The word *crown* is often used as a synonym for *ruler,* as in the phrases *allegiance to the Crown* and *representative of the Crown.*

THE MARTYRDOM OF JESUS
This infinitely tragic figure, pictured and sculptured in virtually every land, stands as a symbol of the faith of all Christians.

CRUCIFIXION, *kroo si fik'shun,* The. Every Christian is familiar with the death of Christ, who was crucified by being nailed on a cross. This form of punishment was meted out to criminals and slaves by the Romans. The cruel death of the Son of God, assuring the salvation of mankind, has been a favorite subject of artists since the sixth century. Until the twelfth century Christ is shown clinging to the cross without signs of suffering. The figure is in robes and wearing a crown, signifying Christ living and triumphant.

Since the twelfth century, the paintings have been more realistic, showing Him suffering and humiliated. In many of the pictures, the two thieves may be seen in the background. Some have other figures present, including Mary, Mother of Christ, Mary Magdalene, and Saint John.

The famous paintings of the Crucifixion include canvases by Fra Angelico, Perugino, Guido Reni, Tintoretto, Dürer, Rubens, Van Dyck, and Murillo.

CRUELTY TO ANIMALS, Society for the Prevention of. The first society to protect defenseless animals from deliberate or thoughtless cruelty was founded in England in 1824. The father of the corresponding movement in America was Henry Bergh (1820-1888), a lifelong leader in the effort to protect animals from man's inhumanity. It was due to his efforts that the American Society for the Prevention of Cruelty to Animals was organized in 1866. This organization has been largely responsible for legislation in the different states, making mistreatment of domestic animals a felony punishable by fine or imprisonment.

Laws of this character apply not only to deliberate abuse of animals, but also to the transportation of animals to market. In order that the cattle, hogs, or other animals may have rest, food, and water, railroads are now required to give them regular care while they are traveling. This reform movement has spread to many other civilized countries. In some countries and in some sections of the United States, there are laws which regulate the treatment of wild animals in cages.

The most important aim of the society is to educate all to treat animals with kindness.

THE CLASH OF MORTAL ENEMIES
Richard the Lion-Hearted, leader of many Crusades, finally met the Turkish Sultan Saladin in the Battle of Ascalon. Neither was defeated.

CRUSADES, *kru saydz'.* The greatest events of the Middle Ages were the several Crusades undertaken by the people of Europe to recapture Jerusalem from the Moslems. Covering a period of nearly two

Above, from one of a series of oil paintings, "A History of Pharmacy in Pictures," commissioned by and copyrighted by Parke, Davis & Co.; reproduced by special permission. George A. Bender, project director; Robert A. Thom, artist.

The Crusaders Came to Conquer— and Lingered to Learn

Many Crusaders feared the influence of the infidel too much to accept his gifts, but others took back to Europe a part of the rich heritage of Islamic civilization, which had reached its height when the Crusades started. The medical and pharmaceutical writings of the brilliant Persian philosopher Ibn Sena (called Avicenna by the Western world) were translated from the Arabic and used as a basis for European medicine for six hundred years. The Arabs were outstanding in the sciences and mathematics. They used the so-called Arabic numerals which they had received from India, and which were to displace the clumsy Roman numerals of Europe. Arab craftsmanship in pottery, mosaics, stained glass, steel implements, book making, leather work, ornamented textiles and rugs was superior to anything like it in Europe. Arab explorers had penetrated the Orient and Africa and controlled trade routes there. The Crusaders brought back to Europe a demand for the products of those far-away places and the Arab learning. Europeans had a Renaissance, or rebirth of learning, and set out on explorations of sea routes that were to lead finally to the discovery of America.

VICTORY FOR THE CRUSADERS
Bearing the Christian Cross in warlike splendor, the knights of the Crusades battled their way toward the Holy Land and the Grail.

hundred years, from 1096 until 1270, they overshadowed every other occurrence in the Western world at the time. They were among the important factors in bringing about the rise of modern civilization.

The Crusades took their name from the Latin word meaning *cross,* the symbol of Christ worn by the knights over their suits of heavy, shining armor. The Crusades were costly and fruitless enterprises, never achieving the ambitious goal of freeing the Holy Land from Moslem rule. But the very fact that they were undertaken had tremendous effect on the future of the world.

Their Effect on Civilization. The Crusades were a wonderful stimulus to the interchange of ideas. Men who had never before been outside the confines of their own villages and estates became acquainted with other men, exchanged ideas, and learned what others were thinking. They found out that life and the world were far more interesting than they had thought when they remained at home.

The power of the Church was increased by the Crusades, providing a unifying bond for all Europe. Then, too, the Crusades helped to bring about the downfall of the selfish and backward feudal system. Nobles who undertook the long and expensive journeys to the East impoverished themselves by borrowing money for the expeditions, and thereby lost their power. In their stead arose free cities and towns. With this freedom, local trade sprang up, and a middle class, hitherto almost unknown, came into being.

The riches of the East, seen and desired by the Crusaders, led to trade between Europe and the Orient and eventually to exploration and the search for new trade routes. Because of the weakening of feudal lords, strong princes became kings, and nations were formed with the feeling growing among the people that they were inhabitants of a nation and not of just a village or a farm. In addition, the ideas and achievements of the civilized people of the East were brought back to Europe by the Crusaders and were spread among the people. The desire to learn and gain knowledge thus was born. The Crusades also tended to reduce the population of Europe, enabling those who remained to have more land and food.

There were several minor effects of the Crusades. One of them was the perfection of the ritual of chivalry (see CHIVALRY). Another was the growth of heraldry, which sprang from the need of heavily armored knights to identify themselves with designs and symbols. Still another result was the introduction of last names for men, resulting from the many Johns, Henrys, Hughs, and Godfreys who were confused unless given other names. Organizations were formed, such as the Knights Templar, who, in their white robes and red crosses, assisted travelers in the Holy Land; and the Hospitalers, who cared for the sick.

Why the Crusades Took Place. During the eleventh century, Europe consisted of many tiny lands, each ruled by a lord. These lords quarreled with one another and with the Pope. Then, the Arabs attacked Constantinople; and, although they were defeated by Alexius, emperor of the Eastern Roman Empire, Pope Urban II feared that they might be successful a second time. Besides, he saw a need for strengthening the power of the Church which had suffered a loss of prestige, and a way of ending the quarrels that plagued Europe. He called a council of the Church leaders and proclaimed a crusade against the Moslems. He decreed that all quarrels must stop until Jerusalem was taken.

Religious orators carried the message throughout Europe. One, called Peter the Hermit, urged many to follow him. They

THE FRENCH CRUSADERS IN THE HOLY LAND

When European knights under Saint Louis campaigned in the lands of the infidels, the Mohammedans asked Saint Louis to become their king. Delegations were sent to the victor's tent to urge the crown upon him, but the Crusader doubted their intent.

Travelers Insurance Company

ON GUARD

This crab of the Indian Ocean is small and does not have a very hard shell. Many fish seek it out in the hope of a crab meat meal. The wily crab, though, wards off its enemies by brandishing a tiny stinging sea anemone carried in each of its fore claws.

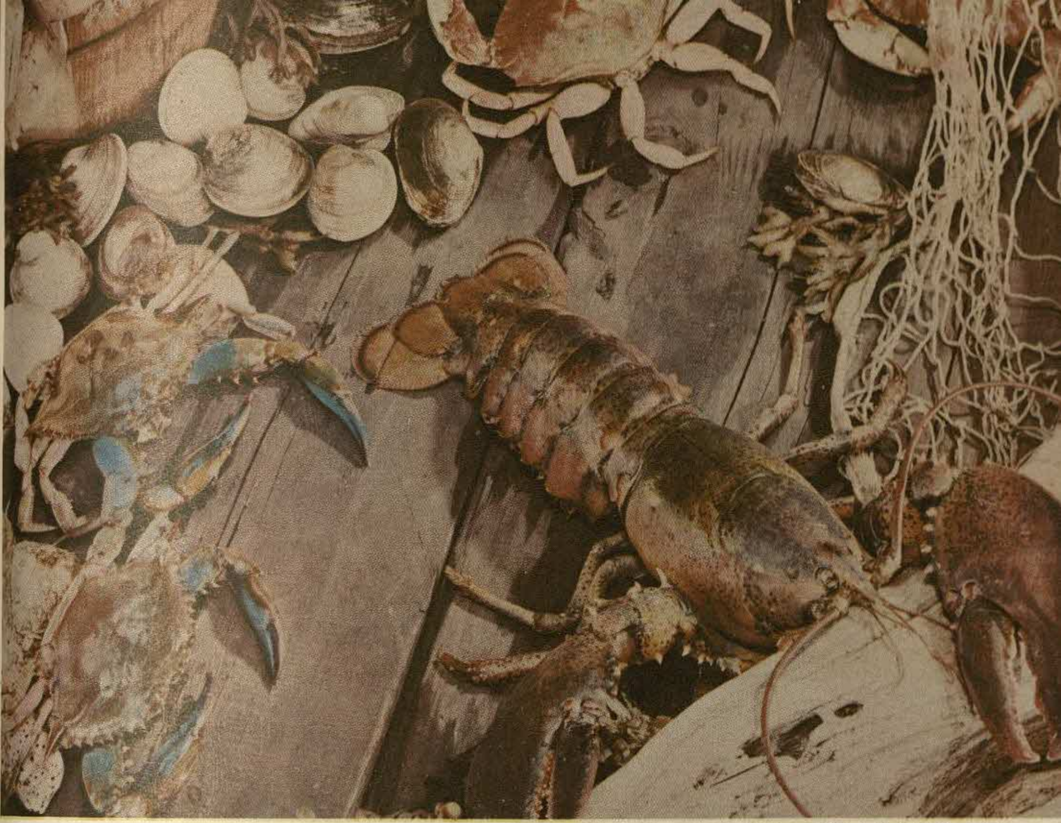
did, only to be massacred in Constantinople. The people were enthusiastic about the Crusades—some for religious reasons; some for the chance to display their skill with sword and lance; others for adventure; and yet others who believed they would receive forgiveness for their sins.

The Eight Expeditions. In 1096 the first Crusade began with the Normans as the nucleus. Forces with Godfrey of Bouillon started from Ratisbon; Adhemar of Puy, Raymond of Toulouse, Robert of Flanders, and Hugh of Vermandois left from Lyons; and Bohemond and Tancred left from Brindisi. At Constantinople (now Istanbul), they combined into a mighty army of 100,000. With banners flying, crosses emblazoned on their armor, and weapons drawn, they invaded the East. Through hard travel and bitter battles, the army was reduced to 20,000 after taking Antioch. The survivors managed to capture Jerusalem, where Godfrey became the ruler in 1099.

The second Crusade in 1147 brought about the loss of the city of Edessa. To regain it, Louis VII and Conrad III made a futile two-year trek from Metz to Acre.

Then a great leader named Saladin appeared among the Saracens, or Moslems. In 1187 he regained Jerusalem. In 1189 Richard I (the Lion-Hearted), Philip II, and Frederick I led the third Crusade. Disputes split the forces but Richard persevered and defeated Saladin. However, he only gained a truce allowing the pilgrims to worship in Jerusalem.

A fourth Crusade, from Venice in 1202, reached Constantinople. There it set up a Latin empire but never reached the Holy Land. By this time, crusading had become a fever and a terrible thing happened: children began to make pilgrimages. In 1212 one children's group left Vendôme, led by Stephen. They reached Marseilles where treacherous shipmasters took them to Alexandria for sale as slaves. Under



Courtesy of Harris-Seybold Company

WHAT'S IN A NAME?

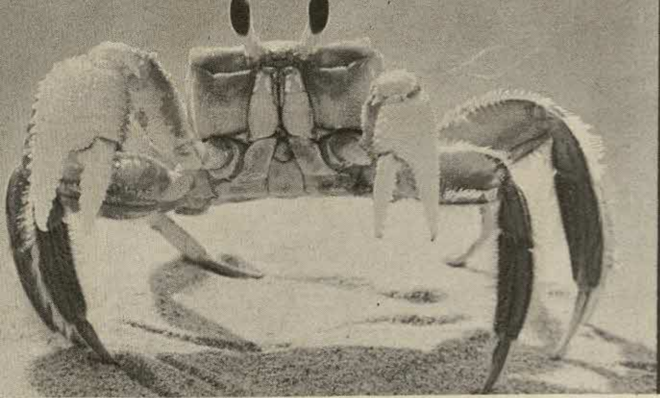
Crustaceans, such as the crab and the lobster, are commonly called shellfish. However, they do not have a shell as the oyster, upper left, has, nor are they fish. They are invertebrates, or spineless animals, and their outer covering is a horny, tough suit of armor. This suit does not stretch. In order to grow, a crustacean must shed its suit and produce a new one in a larger size.

Nicholas another group left Cologne. They halted at Genoa because so many had died along the way. Few of the survivors ever returned to their homes.

In 1218 John of Brienne and Pelagius led the fifth Crusade, which ended three years later without accomplishing anything but a truce. In 1228 another Crusade started out from Brindisi with Frederick II as leader. It ended the next year with nothing important gained. The Crusades came to an end in 1270 after Louis IX had led two. The first began in 1248, ending in 1254, and the last in 1270. Realizing it hopeless, the Europeans made no more attempts to free Jerusalem.

CRUSTACEA, *krus tа́ she ah.* Those who study animals have found that crabs, lobsters, shrimps, sow bugs, barnacles, beach (or sand) fleas, and some thousands of other animals are enough alike to be separated from the other animals and placed in a group of their own. This group is called *Crustacea.* Most of the crustaceans live in the water. However, the little gray sow bugs and pill bugs that scurry away or curl up when we overturn a board that has lain on damp ground are also Crustacea.

All of the crustaceans have a hard outer covering that is like an armor divided into segments. Most members of the group move about on jointed legs. To assist them in finding their way, they each have two pairs of feelers called *antennae.* However, young barnacles attach themselves to the bottoms of ships, and to pilings and other wood under water and remain there throughout their lives.



DISAPPEARING ACT

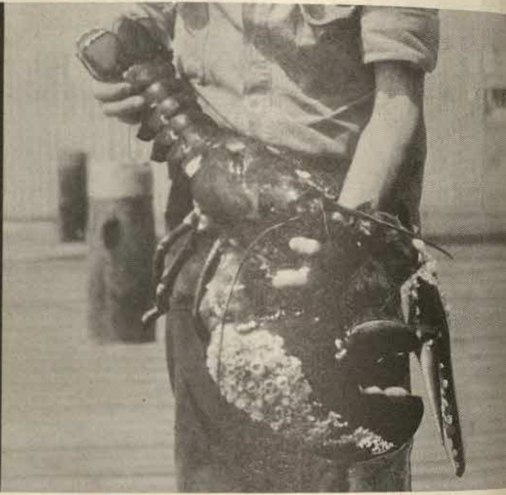
The ghost crab (left) is the color of the beach sands and is invisible without the shadows made by strong light. Its habit is to bury itself in the sand until only the eyes on the tips of their stalks can be seen.

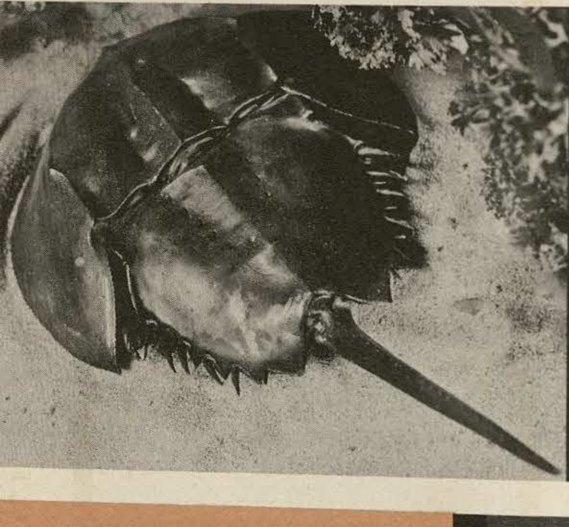
Jack Dermid

ADDED WEIGHT

A lobster, right, may attain a weight of almost fifty pounds. This one has some unexpected poundage contributed by fellow crustaceans, the barnacles. The small claw is called the cutter claw, and the larger one a crusher claw. Even the sharp edges of these claws are "home" to barnacles.

U. S. Fish and Wildlife Service





ARMOR CLAD

The king, or horseshoe, crab (left) moves along the ocean bottom like a small tank. Its armor, surrounding a surprisingly small soft body, protects it from almost all enemies. The flaring fore part of the shell is shaped like a horse's foot. It may reach a width of a foot, and the length, including the lancelike tail, may be more than two feet. Because of its tail this crab is also commonly called the swordtail.

American Museum of Natural History

CHANGEABLE

The live shrimp (right) is normally a grayish color. When it is cooked, though, it becomes a bright pink.

Gorski

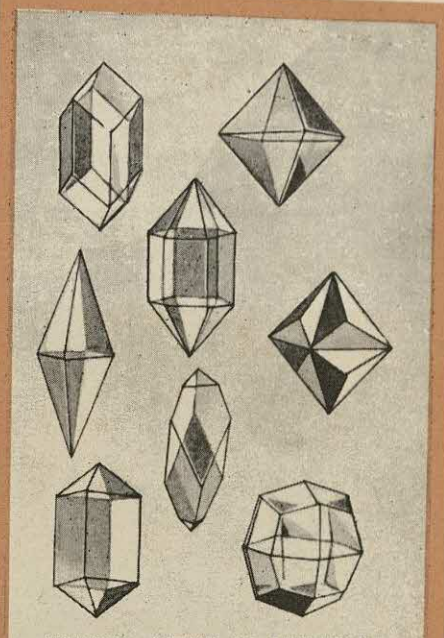
Most Crustacea feed upon dead material and do much good in cleaning up undesirable waste. They do not usually limit their food to dead things, however, but seem to welcome living things when they can obtain them. Some Crustacea live as parasites upon other creatures. Over 200,000 species of Crustacea are known to exist.

CRYSTALLINE, *kris′tal in,* **ROCKS.** These are rocks formed probably as a result of the action of heat and pressure. See Igneous Rocks.

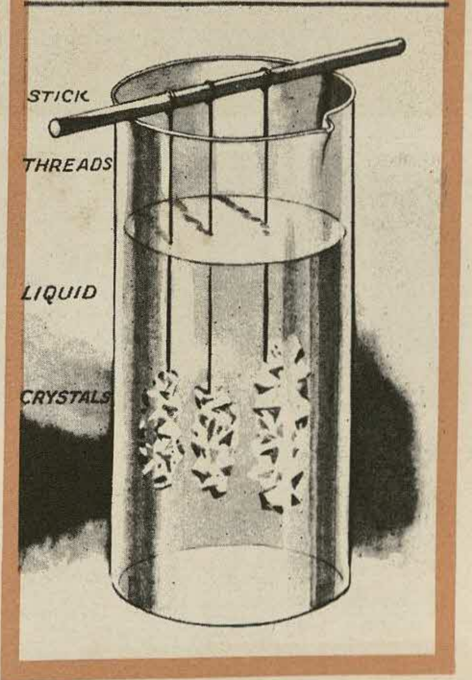
CRYSTALLIZATION, *kris tal i za′ shun.* The process of crystallization may be illustrated by a simple experiment. Dissolve some common table salt in water and pour the liquid into a glass, letting it stand until the water has evaporated. The white deposit left on the glass consists of crystals of salt. Crystallization, then, is the property that some substances possess of assuming definite shapes. It may occur when a liquid becomes solid, when a vapor is cooled, or when a solid separates from a solution. The crystals always have their plane surfaces arranged in a definite and regular way.

All matter is composed of small particles called *molecules,* which arrange themselves, under similar conditions, always in the same way if they are the same kind. Some substances always assume the same form. Others, like sulphur, occur in two forms under different conditions and are called *dimorphous.* When substances of different kinds form similar crystals, they are known as *isomorphous.* Examples are sodium chloride and potassium. Substances that do not form crystals, such as glass and solid glue, are said to be *amorphous.* Sulphur may be amorphous or crystalline.

Glass may be cut in any crystal form but it is not crystalline, for the molecules on solidifying do not assume a definite and regular form. The diamond is crystalline, but the facets cut on the gem to bring out its beauty and sparkle are not the faces of the true diamond crystal. In true crystallization the various planes are always at definite angles to one another in the same crystal.



VARIOUS FORMS OF CRYSTALS

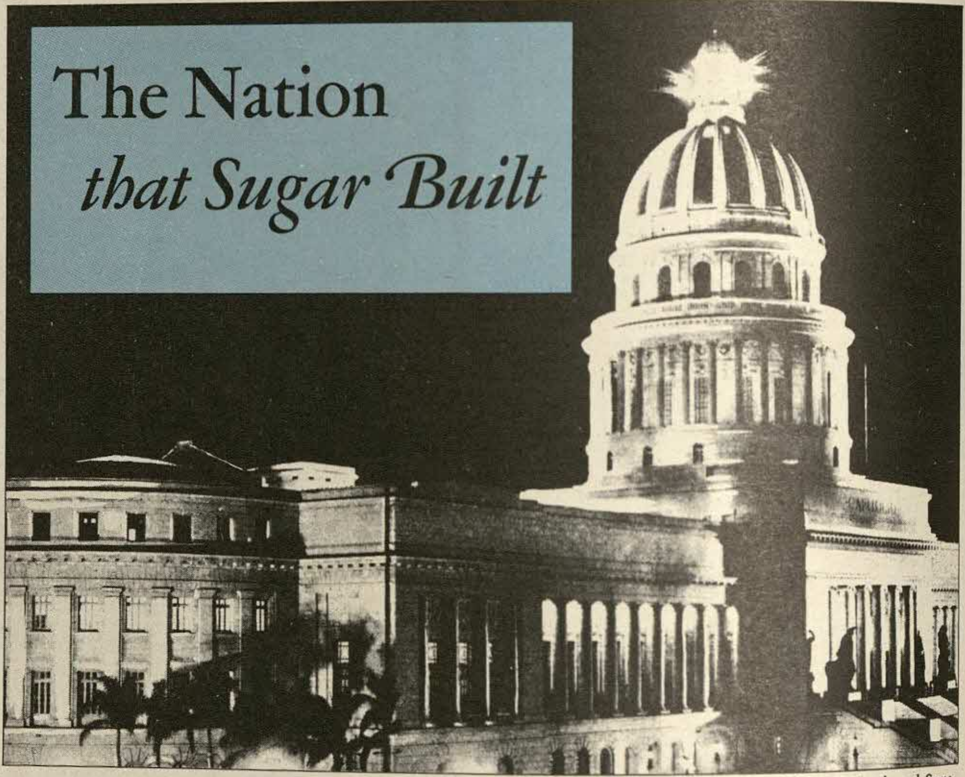


NATURE'S JEWELRY

Many solids, such as salts and metals, are made up of crystal forms, in which they assume thousands of geometric shapes (top). Small salt crystals in salt solution grow into large crystals.

Crystallography, the science of crystals, is important to the chemist and mineralogist because substances may be identified by their crystalline form. Although crystals have many shapes, they may all be classified into six major groups or systems, according to the arrangement of their axes. These are imaginary lines drawn through a crystal with certain reference to the plane surfaces. These systems are based on the general geometric shapes of crystals, such as cubic, hexagonal, and orthorhombic.

The manufacture of steel involves a careful fusing of metal crystals. Straining of metals or extreme heat may cause them to recrystallize into new formations in different directions, increasing the softness and weakening the steel. Railroad rails and building girders are carefully inspected to guard against recrystallization. X-rays are used in studying the construction of the crystal in relation to its outer shape.



The Nation *that Sugar Built*

Courtesy Thomas Cook and Sons

CUBA. A long, narrow island lying just within the tropics, below Florida, Cuba has become a popular vacation land for Americans. The "Pearl of the Antilles," as Cuba is often called, has been described by the American writer, A. Hyatt Verrill, as "a smiling, luxuriant tropic land teeming with life and business, radiant with color and light and combining the enchantment of Oriental Spain with the luxuries, progressiveness, and improvements of twentieth-century America."

Location and Area. Cuba is located in the Caribbean Sea, just outside the limits of the Gulf of Mexico. The western end of the island is almost due south of the east end of Lake Superior and the boundary between Indiana and Ohio; and its eastern end is directly south of Montreal and New York City. The actual length of the island is a little greater than the distance from New York to Chicago, or from Montreal to Port Arthur, Ont., but its width is approximately from 20 to 100

A LOT OF SMOKE
These neat rows of tobacco, growing on a plantation in Cuba, will come to an end in cigars, cigarettes, and pipe tobacco sold throughout the world.

miles. Its area (about 44,000 square miles) is, therefore, no greater than that of Pennsylvania.

Cuba is the westernmost of the West Indian islands. On the west it is separated from Yucatan, Mexico, and on the north from the mainland of Florida, by scarcely more than a hundred miles.

The People. Spain is Cuba's Mother Country. But just as only a part of the citizens of the United States and Canada are of English descent, so only part of the Cubans are of Spanish ancestry. The native Indians whom Columbus found, the Negroes and Indians whom the Spaniards took to the island as slaves, and various Europeans and Americans who have gone to the island have contributed to form a population that is not Spanish but Cuban. Language, manners, customs, religion, music, and art are Spanish. Yet all have been influenced by the non-Spanish members of the population.

Of the more than 6,500,000 residents, about three fourths are white and one fourth colored. Two thirds of the population are native-born Cubans. There are many Spanish, American, European, and Chinese residents. Most of the people live in the rural districts, but there are six cities with more than 100,000 population. Havana, the capital, has more than 1,000,000 residents.

Physical Geography and Natural Resources. The eastern part of Cuba is mountainous and contains one peak more than 8,000 feet high. There are mountains in the western end, but they are not so high. In the center of the island the land is in high, sloping plains.

Caterpillar Tractor Co.

OLD AND NEW IN CUBA
In Cuba, ox-drawn carts bring the sugar cane from the fields. At the transfer station modern tractors transfer the cane into railroad cars for shipment.

The rocky coasts, both north and south, are broken by many natural harbors, but approach to them is often made difficult by islands and coral reefs. Of the many rivers, only one is navigable for more than a few miles.

Rainfall is plentiful, averaging about fifty-four inches yearly. The temperature is pleasant, with an average of about 76°F. The summer heat is tempered by constant breezes, and the nights are cool. The thermometer seldom rises as high as 100°F. Most of the rain is in summer.

The soil of Cuba is in the main easy to cultivate. The most common soil is of a yellowish-brown color. In the north there is much sandy soil.

The island's extensive forests yield mahogany, rosewood, ebony, cedar, and other fine lumbers, dyewoods, fibers, gums, resins, vegetable oils, and charcoal. Royal, date, and coconut palms flourish, and bananas, plantains, and other tropical plants grow wild in many sections. From the encircling seas come sea foods, sponges, turtle shells, and mother-of-pearl. Cuba exports much iron ore to the United States and has deposits of copper, manganese, chromite, asphalt, nickel, tungsten, oil, gold, coal, and salt.

Agriculture. Cuba's great crops are cane sugar and tobacco. Cuban cigars are world-famous, and the island is the second largest sugar-producing country in the world.

Cuba has been producing sugar for four centuries. Today the crop is so important that the island's prosperity largely depends upon its price, and the chief exports are sugar and its by-products. Among the by-products are high-grade molasses, syrup, rum, alcohol, fiberboard, and blackstrap molasses, which has many uses.

Modern cane-crushing mills, which involve an investment of several hundred thousand dollars each, are a necessity in order that most of the sugar contained in the cane may be recovered. On this account sugar production has become a large-scale industry. The "sugar central," as the mill is called, is the center of the sugar plantation, which often covers thousands of acres and employs many thousand workers. Besides the cane from the plantation proper, much cane is also brought in by small growers and contractors. The cane is hauled to the sugar mill over light, narrow-gauge railways, of which there are thousands of miles.

A district in Western Cuba called the *Vuelta-Abajo* produces the finest tobacco in the world. It is this tobacco which has given Havana cigars their world-wide reputation. It grows in a light and rather sandy soil, and the greatest care is taken in raising the better grades. The best tobacco goes into the cigar wrapper. To make sure that the tobacco leaves are not damaged so that they cannot be used for this purpose, the planters not only keep constant watch for caterpillars and tobacco worms, but often build windbreaks of cheesecloth. A good average production is about 1,000 pounds of tobacco an acre. Tobacco is exported as leaf tobacco, cigars, and cigarettes.

Although sugar cane and tobacco are the chief agricultural products, Cuba has a wide range of other crops, partly due to government planning. Among them are coffee, cacao, fiber plants like henequen, rice, corn, coconuts, pineapples, bananas, citrus fruits, papayas, avocados, pimentoes, peanuts, and tomatoes, beans, potatoes, and other vegetables. Fruits and vegetables are shipped north in winter.

Much of the land is excellent for grazing, and conditions are ideal for cattle raising. The stock-raising industry is steadily increasing, with government encouragement. There are good forest foods for hogs, which can be raised cheaply. Other livestock products include sheep, horses, mules, goats, poultry, eggs, honey, and beeswax.

Industry. Sugar and tobacco products are the leading manufactures. Others include canned fish, fruits, and vegetables; textiles and cordage; dairy products, dressed hides, cedar cigar boxes, hats, clothing, pottery, soaps, and perfumes.

Caring for the tourists who flock into colorful, beautiful Cuba each year, especially during the wintertime, is another very profitable industry. The island's tropical, palm-fringed beaches, brilliantly colored birds and flowers, mild climate, deep-sea fishing, horse racing, jai alai games, cockfights, mineral springs, night clubs, and resort hotels attract many to its shores. So, too, do its distinctive music, dances, art, literature, and architecture, all of which are so different from these arts in the United States and Canada that visitors from there feel that they are in a far-distant foreign land.

Transportation and Trade. Being an island, Cuba is essentially a trading nation, exporting much of what it produces and importing much of what it consumes. It has its own merchant marine, and although most of its commerce is with the United States, it also trades with many other nations. The principal port of this "Island of a Hundred Harbors," or "Sugar Bowl of the World," is Havana (Habana). Now Cuba's handsome capital, this port has maintained a key position in Caribbean trade ever since the early seventeenth century, when a Spanish king called it the "Key to the New World and Bulwark of the West Indies." Other major ports include Santiago de Cuba, Cienfuegos, and Matanzas. Excepting inland Camagüey and Santa Clara, all the larger cities are on the coast.

Cuba is linked with the rest of the world by air as well as by sea. Airlines and coastal vessels also connect many of its cities. In addition, the island has excellent railroad and highway systems. Besides its many plantation railways, it has good public lines, one of which spans the country from east to west. The island's improved roads, lined with shade trees and passing many scenic and historic sites, are especially attractive to motorists. The 700-mile Central Highway, opened in 1931, is one of the world's finest motor roads. It crosses the island from east to west and connects all the provincial capitals. All distances in Cuba are measured from a 32-carat diamond set in the floor of the capitol in Havana.

Government. Under its constitution of 1901, Cuba became a republic, with a President, Vice-President, and two-house Congress. Its present constitution, adopted in 1940, patterns the national government after that of several European republics. Under it, the President and Vice-President are elected for four-year terms; the President may not succeed himself. Although the President names the Cabinet, it represents the majority party in the legislature and is responsible to the Congress. All Senators and members of the lower house are popularly elected for four-year terms. The judiciary is headed by a Supreme Court, and each province has a court of appeals.

Voting is compulsory for men and women citizens of twenty years of age and older. The constitution provides for social security, wage-and-hour regulations, a thirty-day vacation with pay for all manual workers, and other progressive measures.

Cuba is divided into six provinces and 119 municipalities, each of which largely manages its local affairs. Each province elects its own governor and legislature.

History. Cuba was discovered by Columbus on his first voyage to America in 1492 and became an important center of Spanish exploration and trade. Ships carrying treasure from Mexico and Peru sailed for Spain from Havana, under the protection of war vessels. As a result, that port was frequently attacked by the English, Dutch, and French buccaneers of the sixteenth and seventeenth centuries. Although none of them ever captured it, many richly laden Spanish ships and their cargoes fell to the raiders. In 1762, during the Seven Years' War, Britain seized the island, but it was returned to Spain by the Peace of Paris in the following year. Through slavery, torture, and disease, most of the island's friendly Indians were exterminated within a few years after the Spanish settlers arrived. To replace them, Negroes were brought in from Africa.

UPI

SOLDIER TURNED DICTATOR

Fidel Castro seized control of Cuba in 1959, ending one dictatorship and starting another. He executed scores of his political enemies, confiscated large holdings of land and private industry, and rebuffed the United States.

With the help of African slaves, the Spanish were cultivating Cuban tobacco and sugar nearly a hundred years before the British began to settle in Virginia. The island was so wealthy that it paid a heavy annual tribute to Spain, amounting in the nineteenth century to tens of millions of dollars annually, although only a small fraction of the land was under cultivation. But the vicious oppression of unscrupulous Spanish governor-generals and the yoke of slavery caused repeated attempts by the Cubans to win independence. The insurrection finally gained sufficient strength by 1895 to merit American attention to the Cuban appeals for assistance.

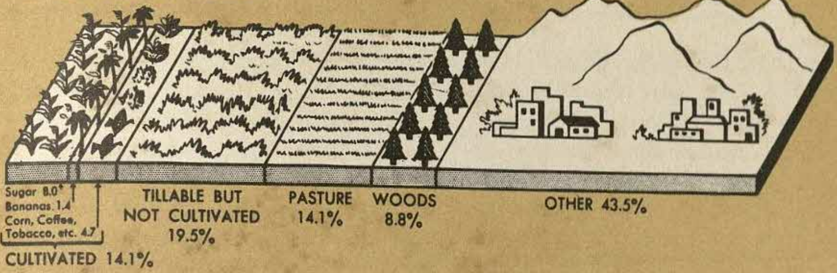
A reason for interference came when the American warship, the *Maine,* was mysteriously destroyed in the Havana harbor February 15, 1898. Spain was blamed for the loss of the *Maine* and her crew. In April, Congress declared that "the people of Cuba are and of right ought to be free and independent." War was declared against Spain. The American forces were soon victorious; and in the Treaty of Paris, December 10, 1898, Spain gave up all claim to Cuba.

The United States occupied Cuba until the Constitution was adopted and Estrada Palma became the first President. As a condition of complete freedom, the Platt Amendment, proposed by the United States Congress, was incorporated in the Constitution. In this amendment, the Cuban government guaranteed that it would not enter into any foreign treaty which might endanger its independence; that it would keep its debts within an amount for which it could safely provide; and that it would grant the United States certain coaling and naval stations.

Most important provision of the amendment, however, was the right reserved to the United States to interfere and assume control of the island to protect life, property, or individual liberty, or to preserve the independence of the island. Under this last provision, the United States intervened when violence accompanied political differences in the election of 1906. The American commission, headed by Secretary of War William Howard Taft, placed the island under a military government until the peaceful accession to the Presidency by General José Miguel Gomez in 1909. American marines were sent to Cuba again in 1916 when political differences once more created violence.

In 1925 the United States returned the Isle of Pines (1,180 square miles) to Cuba. Eight years later the country's army revolted under the leadership of Fulgencio Batista. President Gerardo Machado's administration had become extremely unpopular. Machado took refuge in the United States, and a Provisional Government was set up.

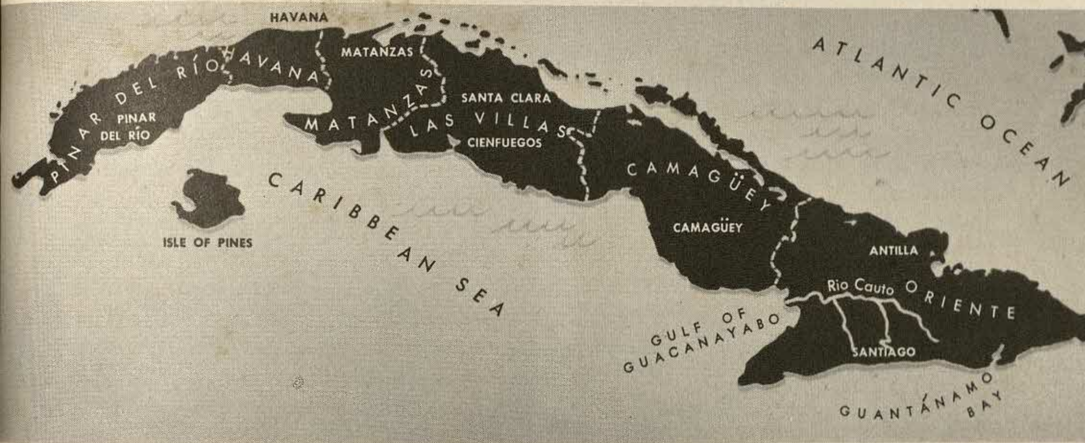
LAND USE IN CUBA



Coordinator of International American Affairs

"PEARL OF THE ANTILLES" — THE SEA ISLAND OF CUBA

Cuba has no inland provinces and, excepting Camagüey, no major cities in the interior. Diversification in agriculture and industrial development are bringing changes in land use.



Cuba had many presidents after 1933 who did not stay in power. In 1934, the United States recognized the Mendieta administration, and renounced the Platt Amendment. Colonel Fulgencio Batista, Chief of Staff of the Army, was the real ruler. He assumed the office of President in 1940 and 1954. Batista was a high-handed dictator and took away many of the liberties of the people.

Fidel Castro took over the government in January, 1959. He dissolved the Congress, removed all officeholders, executed and imprisoned members of the opposition, and did away with elections. The amount of land that could be held by one person was limited, and it was decreed that shareholders in Cuban sugar companies must be Cubans. Foreign-owned properties were seized. The government showed sympathies with Russia and China, and an anti-United States bias. See SPANISH-AMERICAN WAR.

CUBE. Any regular solid whose six faces are equal squares is known as a cube. Children's building blocks are examples of cubical objects.

The volume of a rectangular solid may be found by multiplying the length by the width by the height. Since these dimensions in a cube are equal, the volume of a cube may be calculated by multiplying the length of any side by itself three times. If a cube is measured in inches, its volume will be given in cubic inches; if in feet, its volume will be in cubic feet, and so on.

In mathematics the *cube* of a number means the product of that number multiplied by itself three times. Thus 8 is the cube of 2, since $2 \times 2 \times 2 = 8$. In the same way 27 is the cube of 3, 64 the cube of 4, and 0.125 the cube of 0.5. See CUBE ROOT.

CUBE ROOT. The meaning of *cube root,* in mathematics, is just the reverse of the meaning of *cube* (see CUBE). Where 8 has been shown to be the cube of 2, likewise 2 is the cube root of 8. Also, 3 is the cube root of 27, 4 the cube root of 64, and 0.5 the cube root of 0.125.

It is now easy to see the application of these terms to problems involving the solid known as a cube. Given the length of a side, the volume of the solid may be found by finding the cube of that length. When the volume is given, the side dimension may be calculated by finding the cube root of the volume figure.

However, the cube root is not as easy to calculate as the cube. The reason for this is that not every number has a cube root which is a whole number. For example, the cube root of 27 is 3, that of 8 is 2; therefore the cube root of 21, say, must be somewhere between 2 and 3—or 2 plus some decimal figure.

There are several methods of calculating these decimals. One, an arithmetical method similar to the method of calculating the square root, can be used effectively only for numbers which will give a cube root of two digits. Another method, much simpler, involves the use of logarithms.

The simplest method is not really a method at all. It requires only the possession of a book of mathematical tables. This contains long lists of cube roots which have been computed beforehand. All the student needs to do with such a table is to look opposite the number whose cube root he wishes, and note the figure which is given. Depending upon the accuracy which is demanded by the mathematician, books may be procured with tables of as low a percentage of error as may be necessary.

CUBIC MEASURE. This is used in measuring volume. One may have to determine the volume of earth to be moved in digging a cellar, or the volume of masonry in a wall or foundation. Again, one may wish to measure a quantity of lumber, or cordwood. In any such case, cubic measure would be used, which in the United States and British countries has the following units:

1728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard
24¾ cubic feet = 1 perch
128 cubic feet = 1 cord
144 cubic inches = 1 board foot

The cubic inch is used as a unit in expressing small volumes, such as the contents of measuring flasks. The cubic foot and cubic yard are more convenient units for measuring the volume of masonry and excavations and the displacement of ships.

A cubic inch equals 16.387 cubic centimeters (see METRIC SYSTEM).

GAY FOREST IMITATOR
"Cuckoo!" is not the cuckoo's only call.

CUCKOO, *kook'oo.* When Wordsworth wrote

> O cuckoo! Shall I call thee bird,
> Or but a wandering voice?

he was eulogizing the sweet-toned, musical European bird. In North America there are two common cuckoos and several of rarer occurrence. The *black-billed* cuckoo and the *yellow-billed* cuckoo are found in nearly all parts of the United States and Southern Canada, though the black-billed species does not occur west of the Rocky Mountains, and the yellow-billed bird is much more common in the East and South. They are known as "rain crows" from the belief that their calls are heard most frequently before a rain.

These two cuckoos winter in South America. Both are slim birds, brown above, uniformly white below, and about twelve inches long. The yellow-billed form has the lower half of the bill yellow, some reddish-brown color in the wings, and a black tail with large white spots, characters which are missing in its black-billed relative. They live in forests, hedgerows, thickets, swamps, and orchards, and are very shy and retiring. We more often hear them than see them and soon learn to know the loud *kuk-kuk* notes followed by the softer *kyow, kyow* or *coo, coo, coo* call.

These cuckoos build rude nests of sticks in bushes or tangles a few feet from the ground. Two to seven pale, greenish-blue eggs are laid, and the sitting begins with the first one, so that sometimes young birds and fresh eggs occur in the same nest. Very rarely these cuckoos lay in other birds' nests, a habit which is constant with the European cuckoo and like that of the cowbirds (see COWBIRD). Cuckoos are good friends to the farmer and fruit grower. They are among the few birds that eat hairy caterpillars, especially such as build the tents often seen in fruit and shade trees.

CU'CUMBER. No picnic lunch is complete without sweet or dill pickles. Pickles are cucumbers, the green fruit of a vine known to have existed in Asia at least 3,000 years ago. Cucumbers are now common in all temperate countries. In Southern Europe the cucumber is first cooked before being served, but in America it is popular for pickling and as a fresh salad vegetable.

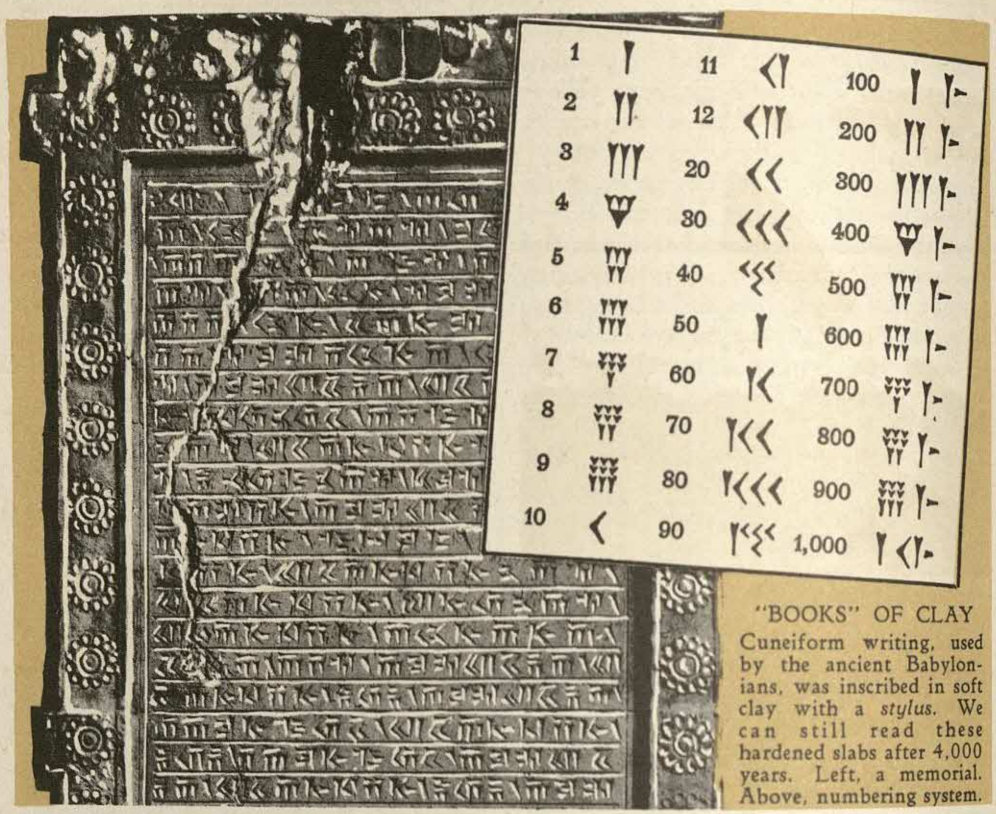
The cucumber vine has tendrils for climbing and often covers a considerable area. Its leaves are hairy and notched about the edges. The fruit is oval and oblong, varying from four to thirty inches in length, and is covered with tiny spines. The smaller pickling varieties are called gherkins. When served fresh, the skin of the cucumber, which contains bitter juices, is sometimes removed. The cucumber is soaked in salt water to remove more of the bitter juices. Among the common enemies of the plant are the cucumber beetle and bacterial wilt.

CUMBERLAND MOUNTAINS. Extending from West Virginia to Alabama, along the boundary line between Virginia and Kentucky, these mountains, a part of the Appalachian system, form a plateau almost fifty miles wide. With a few exceptions, there are no peaks over 2,000 feet in altitude. Rich forests of chestnut, ash, and oak, in spite of a soil too poor for crops, cover the plateau, which also contains valuable deposits of coal and minerals. Its steep slopes are drained by the Tennessee and Cumberland rivers.

Cumberland Gap. This is an opening through these mountains, at the meeting point of Tennessee, Virginia, and Kentucky. The Cumberland Gap was the natural gateway used by Daniel Boone and other settlers to Tennessee and the West, and was used extensively by both armies during the Civil War.

CUMBERLAND ROAD. In the early days of the American Republic, this highway was the most important artery of travel leading to the unsettled Middle West. It was built from Cumberland, Md., for a distance of 800 miles to Vandalia, Ill. The road was constructed in sections, between 1806 and 1840, and it was the expectation of Congress that its cost could be defrayed by the sale of public lands along its route. This assumption proved incorrect, and between 1806 and 1838, the government advanced nearly $7,000,000 to aid the work.

For many years the road was under Federal control, and it was referred to during that period as the *Great National Pike;* another popular name, by which it is yet known to many, is *National Highway.* The road for many miles follows the route of Braddock's disastrous expedition in 1755, and the house which was Washington's headquarters during his command after Braddock's death still stands by the roadside. Braddock's grave is an historic monument a short distance from this house. The Battle of Stone Mountain, in the Civil War, is commemorated by brass plates along the road.



"BOOKS" OF CLAY
Cuneiform writing, used by the ancient Babylonians, was inscribed in soft clay with a *stylus*. We can still read these hardened slabs after 4,000 years. Left, a memorial. Above, numbering system.

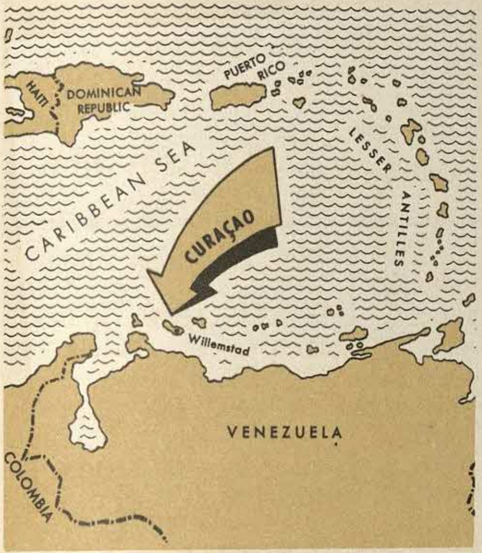
In Pennsylvania and Maryland, the road crosses the ranges of the Blue Ridge, Allegheny, and Cumberland mountains, and presents many delightful views. The Chesapeake and Ohio Canal parallels it for a short distance in Maryland.

CUNEIFORM, *ku ne'i form,* **INSCRIPTIONS.** Laws, letters, business transactions, and history were recorded in a system of *cuneiform* writing by some of the ancient Asiatic peoples. This term, from the Latin word *cuneus,* meaning *wedge,* refers to the characters, which were formed by wedge-shaped strokes in various positions.

Cuneiform is no longer used by any peoples. For centuries the meanings of the records were unknown. In fact, for a long time it was thought that the signs had no meanings, that they were mere astrological symbols or perhaps just the work of worms. Finally, in the nineteenth century, Sir Henry Rawlinson, a British scholar, succeeded in deciphering a number of inscriptions. He thus opened the way for the modern translation of these ancient records.

The characters, representing syllables or words rather than letters, were first carved in stone, but soft clay tablets were introduced for common use. A small stylus, made of reed or metal, produced the wedge-shaped marks, and the clay was baked for preservation. The Sumerians, who had an advanced civilization more than 3,000 years before Christ, were the first to use cuneiform writing. It was later adopted and varied by the Persians, Chaldeans, Babylonians, and Assyrians.

CU'PID. The chubby little unclad boy whose picture we see so much on Saint Valentine's Day is Cupid, the god of love. According to ancient myths, he was the son of Mars, the god of war, and Venus, the goddess of love and beauty. Cupid was equipped with wings, a bow, and a quiver



Acme

DUTCH COLONY — FAMED SCIENTIST
The map above locates Curaçao, a Dutch outpost in the New World. At right is Madame Curie, one of the first women to win international recognition in the field of science.

of love arrows, with which he is still pictured. Modern artists have changed Cupid from a handsome boy to the familiar, babyish figure. Mythology says the original Cupid fell in love with a beautiful mortal, Psyche. That they might be together, the gods made Psyche immortal. Cupid was the emblem of the heart, and Psyche the emblem of the soul.

CURACAO, *kyur uh soh′*. Lying in the Caribbean Sea are two groups of tropical West Indian islands comprising the Netherlands Antilles. Formerly the Dutch colony of Curaçao, they now form an overseas territory of the Netherlands. The three largest islands — Curacao, Bonaire, and Aruba — belong to the Windward group and lie some forty miles north of Venezuela. St. Martin (half Dutch), St. Eustatius, and Saba, belonging to the Leeward group and some 500 miles to the northeast, are much smaller. The capital, Willemstad, is on Curaçao, which covers 210 of the territory's 403 square miles and has over 102,000 of its 165,000 inhabitants, mostly Negroes, English, Dutch, and Venezuelans. The chief industries are the refining of Venezuelan oil, in the giant refineries on Curacao and Aruba, and the making of curaçao liqueur. Having little arable soil, these coral islands must import most foods, but some corn, pulse, fruits, and livestock are raised.

CURIE, *ku re′*, PIERRE (1859-1906), and MARIE SKLODOWSKA (1867-1934). As thrilling as valuable, and as important to the world as the finding of a new continent was the discovery of radium and its uses by Pierre and Marie Curie. Husband and wife, they worked together as adventurers of the laboratory, disdaining wealth and glory for the greater achievement of advancing science and civilization.

Pierre Curie was a Frenchman, born in Paris. As a student at the Sorbonne, he became interested in electrical research and succeeded in obtaining the post of professor of physics. In 1895 he met and married Marie Sklodowska, a blonde, blue-eyed Polish girl who had gone to Paris to follow her father's profession of scientist. She had been exiled from Russia, of which Poland was then a part, because of her strong desire to free her native land from the yoke of the czars. Poor, like Pierre, she tended furnaces and swept floors in order that she might pursue her studies.

One day a professor went to Marie and told her he had noticed that some uranium ore which he had left on a photographic plate in a darkroom had caused a spot, such as might be produced by exposure to light, to remain on the plate. To scientists, this meant something mysterious and strange, for it indicated a new, radiating element which had never before been isolated. Marie and Pierre Curie became interested, secured a ton of *pitchblende,* and set to work exploring the sandy ore. After two years of work in a small, ramshackle shed, they succeeded in finding the new element, which they called *polonium* in honor of Marie's beloved Poland.

But greater things were to come. Continuing their experiments, they found that there was an even stronger power than polonium present in the pitchblende. It turned out to be radium. In 1903, when Marie Curie told of the discovery in her thesis for a doctor's degree, the work of the two scientists was hailed as one of the greatest contributions ever made to the world of science. They did not patent their discovery but donated the minute crystals of radium to hospitals. In that year the world paid homage to the Curies by awarding them the Davy Medal of the Royal Society and half of the Nobel Prize in physics.

Three years later, Pierre Curie was killed in an accident, but Marie went on with her work. She succeeded Pierre as professor of physics at the Sorbonne. Later, in 1911, she received the Nobel Prize in chemistry for isolating pure radium.

Madame Curie died in 1934 at the age of sixty-seven. But her work is being carried on by her daughter, Irene Curie-Joliot, who, with her husband, Frederic Joliot, won the Nobel Prize in 1935 for their work in radioactivity.

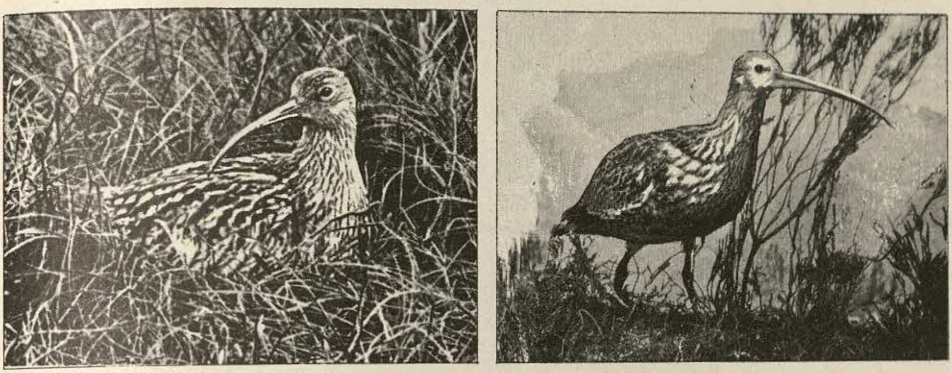
The younger daughter, Eve Curie (1904-), became a musician, lecturer, and author. Her biography of her mother, *Madame Curie* (1937), was translated into many languages. She worked tirelessly to promote the Allied cause in World War II. See RADIOACTIVITY; RADIUM.

CU'RIUM. While working on the atomic-bomb project at the University of Chicago in 1944, scientists Glenn T. Seaborg, R. A. James, and A. Ghiorso produced an element that had never before been known. This metallic substance, produced by bombarding plutonium atoms (Pu= 239) with helium ions, was named curium after Marie and Pierre Curie, the world-famous scientists whose investigations of radioactive substances had helped other scientists to unlock the secrets of the atom. The symbol for this element, which has never been found in nature, is Cm. Its atomic weight is 242; its atomic number, 96. See CHEMISTRY; PLUTONIUM.

CURLEW, *kur'loo.* A shore bird of the snipe and sandpiper family, the curlew is closely related to the sandpipers, but is larger and has a long, downward-curving bill. The *long-billed* curlew of the interior United States and Southern Canada is about two feet in length, with a six-inch bill. The *Hudsonian,* or *Jack,* curlew and the *Eskimo* curlew are somewhat smaller birds breeding in the Arctic regions and wintering in far South America.

All these birds frequent muddy shores and damp, grassy meadows, but often nest quite far from water. They feed on worms, insects, mollusks, and small water animals. During migration they have been shot as game birds and are becoming scarce, especially the Eskimo curlew, which is almost extinct.

CUR'RANT. The small acid fruits borne by the currant plant, a well-known member of the saxifrage family, are widely used in making jams and jellies. For this purpose they are unexcelled, but they are also a refreshing dessert fruit when eaten with sugar. There are about twenty species, native to the colder climates of the world, but only two in general cultivation—the *red* and the *black* currants. These are both native to Northern Europe, but are raised



THE MARSH BIRD WHO CALLS HIS OWN NAME

Curlews, so-named because of the sound of their peculiar whistling cry, nest in tall reeds near water (left). The female sits on her eggs, almost invisible because of her protective coloration. Curlews resemble snipe and woodcock and some species have been exterminated by hunters.

generally in America. The black currant is more popular in Europe; the red species is a favorite in the United States, as is the *white* currant, a cultivated variety of the red. The *wild California flowering* currant is a purely decorative shrub, producing large, beautiful pink flowers.

Currants are bush plants and are started from cuttings which root readily in moist ground. They grow best in mellow, well-drained soil, and being shallow-rooted plants, will not thrive where the surface soil is hard, dry, or hot. Being hardy they are able to survive rigorous winters. Moreover, they will grow well under shady conditions, enabling a skillful gardener to utilize space otherwise left vacant.

Currants are picked in clusters and packed in one-quart boxes in twenty-four-quart crates for market purposes. Under good conditions, currant farms have produced as much as 400 bushels per acre.

The greatest enemy of the currant is the currant worm, which strips a bush of its leaves in a short time. These worms are controlled by spraying with a solution of white hellebore.

The small berries used in buns and cookies are also called currants. These are a small seedless raisin originally brought from Corinth, Greece (see RAISINS).

CUR'RENCY. See MONEY.

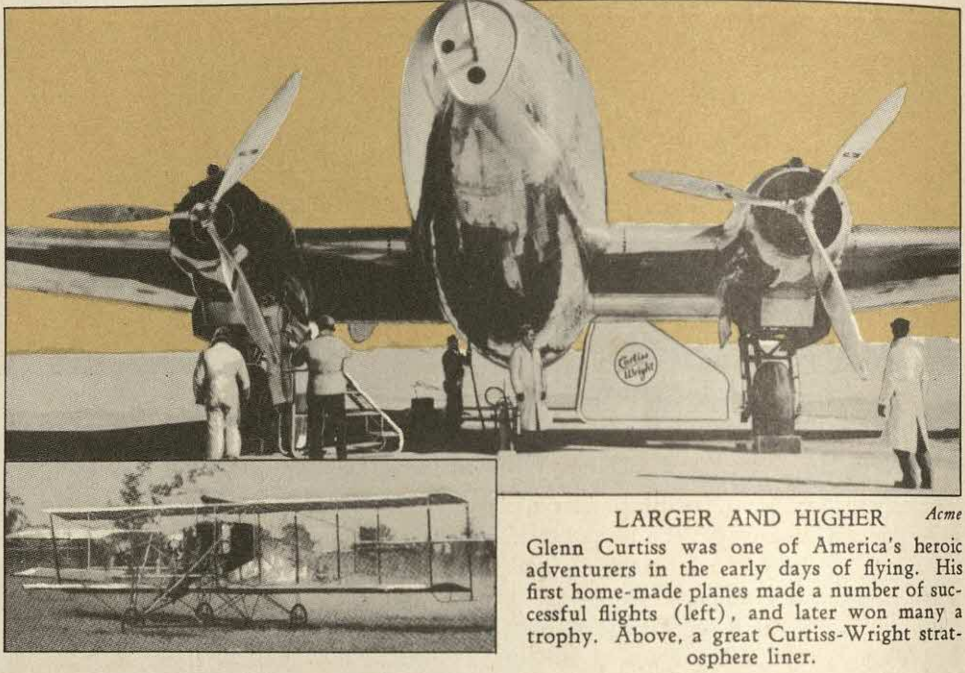
CURRENTS, OCEAN. See OCEAN CURRENTS.

CUR'TISS, GLENN HAMMOND (1878-1930). With the exception of the famous flying brothers, Orville and Wilbur Wright, no one contributed more to the advancement of flying in America than Glenn Curtiss. His greatest claim to fame was his invention of the flying boat.

From his early boyhood days in Hammondsport, N. Y., Curtiss was greatly fascinated by mechanical vehicles. He first came into prominence in 1906 by building a special 110-pound motorcycle and racing it to a new world's record of 26.4 seconds per mile, over 136 miles per hour, at Ormond Beach, Fla. Two years later he carried off the *Scientific American* trophy by piloting an airplane, the *June Bug,* on the first public flight of a mile in the United States.

The following year he won the Gordon Bennett trophy in Rheims, France, by flying a plane forty-seven miles per hour, a great achievement in those days. Again, in 1910, he carried off the New York *World* $10,000 prize, flying from New York to Albany, a distance of about 150 miles, with only three stops. This flight was made in two hours and fifty-one minutes.

Shortly after this race, Curtiss developed his famous flying boat and hydroaeroplane, an achievement which brought him the Aero Club of America trophy. In 1913 he was presented a medal by the Smithsonian Institution; the following year he flew the



LARGER AND HIGHER Acme

Glenn Curtiss was one of America's heroic adventurers in the early days of flying. His first home-made planes made a number of successful flights (left), and later won many a trophy. Above, a great Curtiss-Wright stratosphere liner.

famous Langley machine, built in 1903, but never before successfully flown.

During World War I, Curtiss joined with John N. Willys, a builder of motor cars, and expanded the Curtiss airplane plant to supply America with fighting planes. In 1919 a modern Navy-Curtiss flying boat made aviation history when it was flown across the Atlantic for the first time.

CUR'WOOD, James Oliver (1878-1927). The beauty and drama of the Canadian Northwest are portrayed in the stories of James Oliver Curwood, an American newspaperman who turned novelist. In order to give realism and vividness to his tales, Curwood thoroughly studied the Canadian wilds and the life, and became an authority on the subject. This accuracy of detail is an outstanding feature of his works.

A native of Michigan, Curwood was educated at the state university, and began his writing career as a reporter. He was editor of the Detroit *News-Tribune* from 1900 to 1907, when he decided to devote all his time to writing fiction. Among his stories are *The Flower of the North, Nomads of the North, The Valley of Silent Men, Black Hunter,* and *The Plains of Abraham*. Some of his books have been adapted for the moving-picture screen.

CUS'TER, George Armstrong (1839-1876). On a day in June, 1876, the Sioux Indians led by a medicine man, Sitting Bull, surrounded a detachment of troops of the United States Army on the Little Big Horn River in Montana. The entire force of 264 men was wiped out. Not even their general, dashing George Custer, rode back, and the tragic battle went down in the lore of the West as "Custer's Last Stand." The field of battle is now a national cemetery.

It was fitting that George Armstrong Custer should have died leading his men in battle, for his entire career was that of a brilliant soldier. Following his graduation from West Point (1861), he became an officer in the Union army in the Civil War, attaining the rank of major general.

When the war was over, Custer commanded the troops in the rapidly growing West, where the Indians were on the

THE FEARLESS CUSTER SETS FORTH ON HIS LAST RIDE

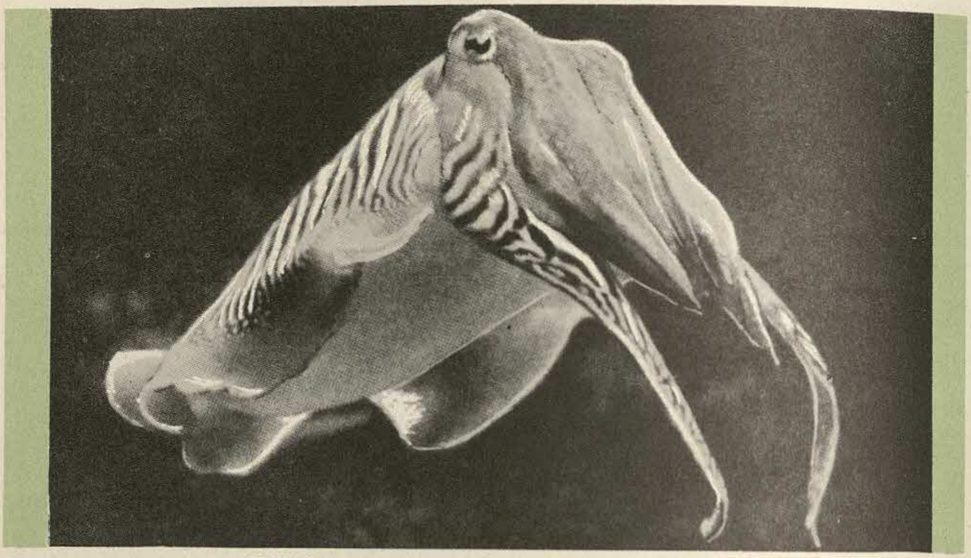
This heroic American general was famous for his conquests of the Indians in the early days of the West. But in a terrific battle with the united tribes under the Sioux chief, Sitting Bull, Custer's men were surrounded. Before help could arrive, they were massacred.

warpath. He was successful in quelling many of the uprisings until the battle on the Little Big Horn. Longfellow's poem, *The Revenge of Rain-in-the-Face,* tells the story of Custer's last stand.

CUS'TOMS DUTIES. When taxes are imposed on goods entering or leaving a country, they are commonly called tariffs, or customs duties. Such taxes date back to ancient Greece, but the name customs duties originated in England in the latter part of the thirteenth century. In a prolonged argument between the Crown and Parliament concerning the right of taxation, it was maintained that the Crown had acquired the right to tax imports and exports "by custom." The name was thus retained after the argument had been settled by legislation. The first English customhouse dates from 1304.

Since customs duties are generally levied only on imports, they are commonly spoken of as import duties. Such duties may be either *specific* or *ad valorem*. Specific duties are based on quantity, weight, or number, as, for instance, a tax of ten cents per bushel on imported wheat. *Ad valorem* means *according to value*. That is, flour might carry an ad valorem duty of twenty per cent of its value regardless of what that value might be. A few imports, especially such luxuries as perfume, may carry both specific and ad valorem duties. Other products, not produced at home and in great demand, may be placed on a "free list," carrying no tariff; or they may be subject to a very low tariff. Some commodities, such as coffee in Brazil, are subject to an export tax.

Taxes may be levied on imports for two reasons; either to raise revenue or to protect the home producer from foreign competition. The amount of the duty added to the cost of an imported article may make the



USEFUL RELATIVE OF THE OCTOPUS

Part of the bone structure of the cuttlefish provides the familiar cuttlebone, beak-sharpener for canaries. The creature, who lives in tropic seas, swims by flipping the membranous "wings." He can eject an inky fluid for protection.

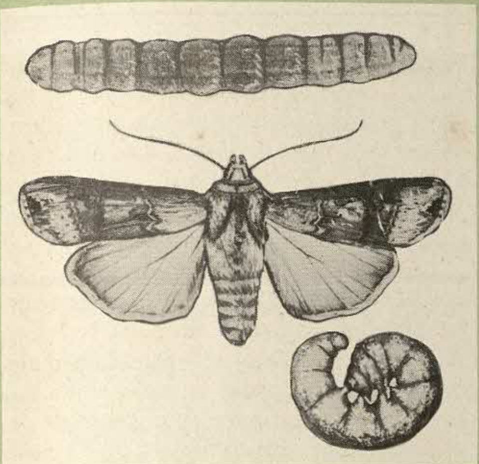
product more expensive than the corresponding article produced at home, and the consumer will prefer to buy the latter. Thus the "protective" tariff sustains home industries. Since the beginning of the American nation, a bitter argument has raged between the friends of free trade, who want no tariffs imposed on imports, and the protectionists, who insist on maintaining a protective tariff for the benefit of home industry.

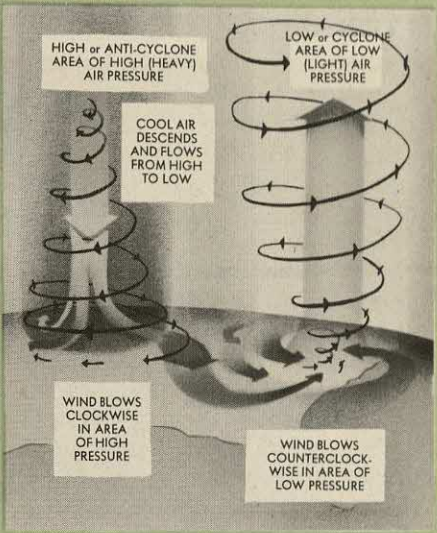
Since 1846, bonded warehouses have been maintained in the United States, where importers may store their goods until they are able to pay the duty. If the goods are later exported, they are withdrawn from bond without the payment of any duty. Warehouse receipts, showing the possession of imported goods, are often used as the basis of credit by importers in borrowing money from banks. In some countries, a large part of the national income is derived from customs duties. See FREE TRADE; TARIFF.

CUT'TLEFISH. Like some evil-eyed creature skulking in the deep, ready to pounce on its unsuspecting prey, the "goggle-eyed" cuttlefish dwells in its self-made security. This queer-looking pear-shaped mollusk, found in all seas, has eight sucking arms, arranged in pairs about its mouth. It is also equipped with a pair of long tentacles, which are likewise furnished with suckers. The cuttlefish uses its arms to catch small fish, shrimps, and crabs, which it kills with its suckers. Sense organs similar to ears are located on its head, and it has two eyes. Though most cuttlefish never exceed a length of nine inches, the largest may reach seven feet in length.

The cuttlefish usually scurries backward in retreating from an enemy, and covers up its retreat with a heavy cloud of black sepia, which is discharged from the body through a tube near its head. By means of a siphon-like arrangement, this tube also draws in water, from which the creature gets oxygen.

The "smoke screen" of sepia is used as a deep brown pigment for water-color painting. The bone from the interior, known as cuttlebone, is used as a beak-sharpener for caged birds. This bone is also employed in the preparation of tooth powder. Cuttlefish are related to the octopus, nautilus, and squid. See MOLLUSCA.




HIGH or ANTI-CYCLONE AREA OF HIGH (HEAVY) AIR PRESSURE
LOW or CYCLONE AREA OF LOW (LIGHT) AIR PRESSURE
COOL AIR DESCENDS AND FLOWS FROM HIGH TO LOW
WIND BLOWS CLOCKWISE IN AREA OF HIGH PRESSURE
WIND BLOWS COUNTERCLOCKWISE IN AREA OF LOW PRESSURE

U. S. D. A.

FARMERS' FOES — WHIRLING WINDS
Above, cutworms and the moth into which the caterpillar grows. Right, Northern Hemisphere wind systems — an anticyclone and a cyclone.

CUT'WORM. This stout, soft-bodied caterpillar is one of the most troublesome insects to gardeners and farmers. Feeding at night on almost any kind of a plant, the cutworm kills grain crops or vegetables by cutting off the young plants near the surface of the ground. Some kinds climb trees and eat the tender green leaves. The most effective means of destroying the pests is to spread poisoned bran in the field. Cutworms may be identified by their smooth, cylindrical shape and gray bodies, which often are spotted or striped. These caterpillars are the larvae of various night moths.

CYCADS, *si'kadz.* Among the most ancient plants to be found living on the earth are the cycads—large, leafy plants, palmlike in appearance. Being cone bearers, they are more closely related to the pines than the palms. The wood of these plants is non-resinous and very pithy. Cycads grow in Australia, India, South Africa, and tropical America. In Australia they grow to mammoth proportions. One species in Southern Florida grows very widely.

Cycads belong to a group known as *gymnosperms,* flowering plants that bear naked seeds and pollen. The ancestors of the gymnosperm group make up a large part of the dense forests from which coal was formed thousands and thousands of years ago.

CYCLAMEN, *sik'lah men.* Possessing extraordinary beauty in its inverted, large-petaled flowers and handsome foliage, the cyclamen, a member of the primrose family, is a popular plant in florists' shops. Its blossoms are usually clear in color—red, white, purple, rose-pink, salmon—but sometimes two colors are found in one flower. There are also butterfly varieties which are fringed and crested. This plant is a native of Europe and Asia. Today, however, it is common in Canada and the United States.

CYCLONE, *si'klone.* Whirling wind storms with their accompanying clouds and downpour of rain are known as cyclones. Originally the term was applied only to the large, rotary, tropical storms; but it is now applied to any system of spirally inflowing winds. In ordinary usage, however, the cyclone is the large atmospheric whirl hundreds of miles across, and not the small vortex that carries the special name *tornado* or *waterspout.*

South of the equator the movement of cyclonic winds is clockwise. North of the equator, however, the movement is counterclockwise, the difference being due to the curvature of the earth.

Cyclones are not unusual. In fact, one or two may be observed on any daily weather map. We notice them because, as they pass by, the weather conditions change; but only a few cyclones are of sufficient intensity to cause the damage usually associated with them.

On a weather map the cyclone is the low-pressure area and is marked with the word *Low.* It is surrounded by black lines called *isobars* (designating the atmospheric pressure) and by arrows pointing to the center, showing the wind direction. Rain also is indicated on the maps, bordering the center of the cyclone. A cyclone usually moves eastward and changes shape gradually as it moves.

Cyclones are heralded by the approach of cirrus, then cirro-stratus and alto-stratus clouds, the sky becoming increasingly cloudy (see CLOUD). The temperature rises, rain or snow falls, the air pressure drops, and the wind increases. Then comes a heavy shower, the wind shifts to the west, and the sky begins to clear. The cyclone has passed and an anticyclone is on the way.

An anticyclone is a system of winds in which the direction is just the reverse of the cyclone. It usually follows a cyclone. Since it constitutes the high-pressure areas on the weather maps, it accounts for weather alternating between low and high pressures. In an anticyclone there are usually clear skies, and the weather is cool before the center of the disturbance arrives. By following the course of these cyclones and anticyclones, the weather man is able to forecast conditions several days in advance.

One of the reasons why cyclones may be so severe is that warm surfaces intensify cyclones and weaken anticyclones. Cold surfaces, however, strengthen anticyclones and weaken cyclones. See HURRICANE; STORMS.

CYCLOPS, *si'clops.* A one-eyed giant, a Cyclops was a member of a strange race mentioned in the myths of the ancient Greeks. According to one legend, the Cyclopes were shepherds living on the island of Sicily, where mythical Greek heroes had some exciting adventures. Another legend tells of only three Cyclopes, sons of Uranus (Heaven) and Ge (Earth), who aided Vulcan in the forging of armor and thunderbolts.

CYCLOTRON. See ATOM SPLITTING.

CYLINDER, *sil'in dur.* Roll a rectangular piece of cardboard until its two long sides meet, and completely round openings, the same size, appear at each end. You have made a cylinder, the principle involved in pipes, steam boilers, and smokestacks; in fact, one of the most important elements in mechanical construction. The outer curved surface is called the *convex surface* and the circular openings are the *top* and *base,* respectively.

To find the area of the surface, multiply the circumference of the base by its altitude. You can easily understand this rule if you recall that the cylinder was made from a rectangle, that the circumference of the base is an end of that rectangle, and the altitude is equal to the length of one of its sides. To find the area of the base, employ the formula for the area of a circle: $Area = 3.1416 \times radius^2$. The volume is found by multiplying the area of the base by the altitude. See CIRCLE.

CYPRESS, *si'pres.* Four hundred years ago, the Spanish *conquistadores* in Mexico were impressed by the great size and evident age of the famous Montezuma cypress in the wonderful Gardens of Chapultepec, at Mexico City. Today this cypress still stands—probably over seven centuries old. Cypress trees grow in many parts of the world, and everywhere are known for the great age which they attain and for the lasting qualities of their timber. The Egyptians used cypress wood to make mummy cases which have endured thousands of years; other ancient peoples made their wine presses of it and engraved their laws on cypress tablets; and Pliny, the Roman, mentions a statue of Jupiter which in his time was 600 years old and still undecayed.

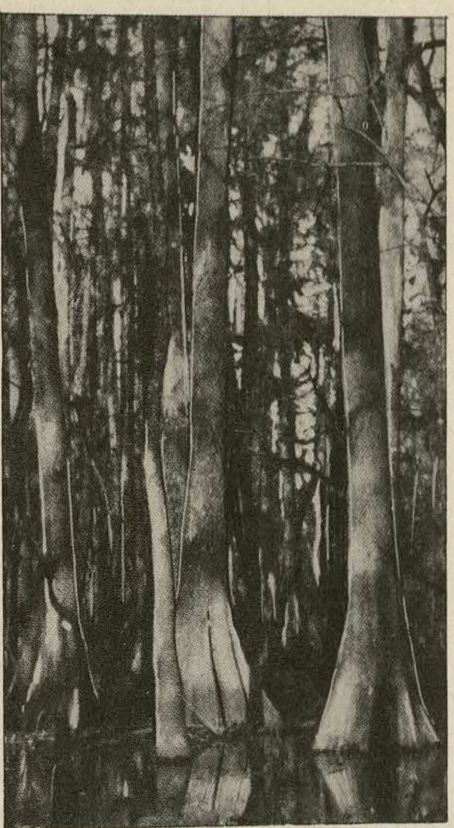
In Shakespeare's *King Henry VI,* the

Duke of Suffolk wishes that his enemies may have as "their sweetest shade, a grove of cypress trees," which is another way of saying that he would like to see them in their graves, for, because of their long life, cypresses are commonly planted in cemeteries in Europe, especially in Italy and the Near East.

Of several species grown in the United States, the *bald* cypress of the South is most important commercially. Its heartwood is so enduring that a Connecticut roof shingled with it served for 250 years. The wood is used in the construction of silos, watering and feed troughs for farm animals, barns, fences and fence posts, gates, and telephone poles. Because the wood resists decay, it is also important in greenhouse construction. Like the tamarack, the bald cypress sheds its needles in winter, and it is one of the few trees that can live in water.

CYPRUS, *si'prus*. Located in the northeastern part of the Mediterranean Sea, the island of Cyprus has watched civilization come and go since the Bronze Age, when its copper was sought by every conqueror. The word *copper* comes through the Latin from the Greek name of the island. It is 140 miles long and its greatest width is sixty miles. The area is 3,572 square miles. The population is about 549,000. This historic island has felt the power of Darius of Persia, Alexander of Macedonia, the Ptolemies of Egypt, the Caesars of Rome, the Turkish sultan, and the British Lion. Cyprus was annexed by Great Britain in 1914. After a four-year war between the Greeks who wanted union with Greece, and the Turks who favored British rule, Cyprus became an independent republic August 16, 1960, with a definite plan for representation of both Greeks and Turks in its government.

The residents of Cyprus use irrigation to raise wheat, barley, oats, olives, cotton, and grapes. Its minerals include asbestos, from which firemen's suits and brake linings are made, gypsum, terra umbra, and marble. Sponge fishing is carried on. Very mountainous, Cyprus sometimes suffers disastrous earthquakes. Since it is a key point in Near East defense, Britain and the United States maintain air and military bases there.



THE WOOD ETERNAL

The towering, smooth-barked cypress grows in swamps, and produces a wood which is almost impervious to weather, even without paint.

Colorful Nicosia is the capital; Famagusta, the chief port. Most of the Cypriotes, or Cyprians, are Greek Orthodox Christians; others, Turkish Moslems.

CYRUS, *si'rus,* called THE GREAT (about 600-529 B. C.) Founder of the Medo-Persian Empire, Cyrus the Great was one of the mighty rulers of ancient times. He was praised by Herodotus, the Greek historian, as a wise man. And the prophet Isaiah called Cyrus "the anointed of the Lord" because he freed the Jews from Babylonian oppression.

PERSIA'S CELEBRATED EMPEROR RELENTS

Cyrus the Great returning the sacred vessels to the Jews, from whom they had been stolen.

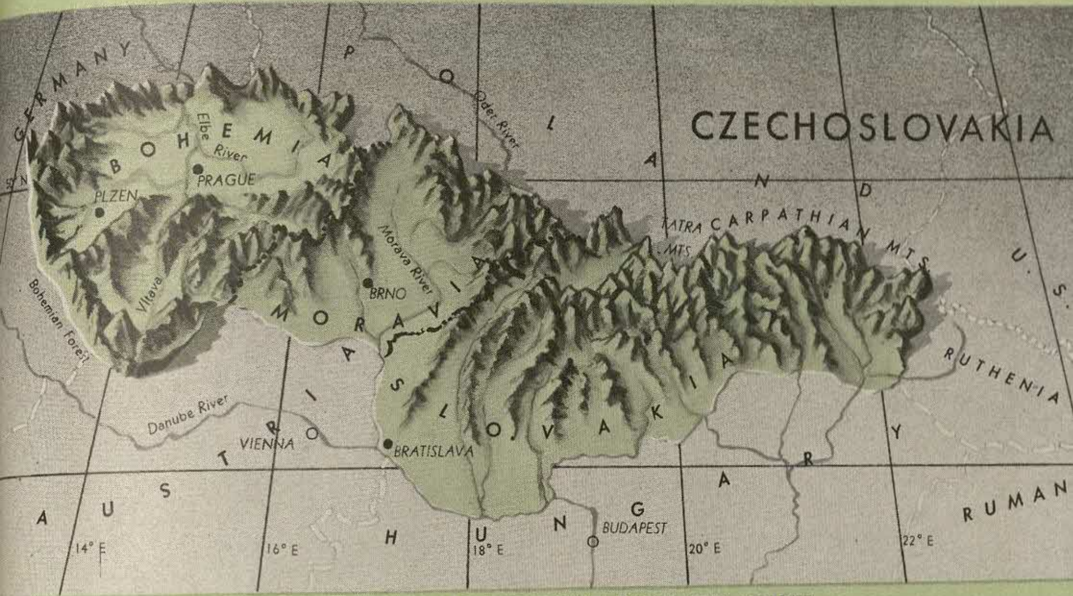
Little is known of his childhood, although a number of stories about him have been handed down through the ages. According to one legend, his grandfather, Astyages, dreamed that his grandson would one day overthrow him as ruler of the Medes. Astyages, therefore, commanded that the young Cyrus be put to death; but through the kindness of a court soldier, the infant was given to a herdsman and so was spared.

At any rate, when Cyrus grew to manhood, he did not succeed his grandfather. He united the many Persian tribes and became ruler of Media and Persia. That was the beginning of his spectacular career. Gradually he enlarged his kingdom until rulers to the west began to fear for their own lands. Croesus, king of Lydia, formed an alliance with Babylonia and Egypt. But Cyrus marched into Lydia and captured the country. Later he conquered Babylonia, too. He extended his empire eastward, also, by taking what is now Afghanistan. In fact, the empire of Cyrus eventually extended from Northern Asia Minor to the Indus River in Western India.

In 529 B. C., however, the career of Cyrus came to an end. He was killed in battle in an expedition against the Scythians to the north of his empire.

Cyrus the Great was a wise and able ruler. History credits him with having a firm character, being a wise lawmaker, and in many other ways being an ideal king.

CYRUS, called THE YOUNGER (? -401 B. C.). Greed for power led this Persian prince, son of Darius II, to defeat and death



THE DAGGER THAT LOST ITS POINT

Czechoslovakia was once shaped like a dagger, but the point was snapped from the blade when the Soviet Union took over Ruthenia after World War II. The mountains, valleys, and plains of the nation are boldly defined in this relief map of Czechoslovakia.

at the hands of his brother, King Artaxerxes. From the beginning, Cyrus was jealous of his brother and once, for an earlier conspiracy, had been sentenced to death. At that time his mother obtained a pardon for him, and he was sent into Asia Minor as governor.

Not content, Cyrus secretly raised a large army and also hired 13,000 Greek soldiers, among whom was the famous historian, Xenophon. News of his plot reached the king, who surprised Cyrus in a battle at Cunaxa in 401 B.C. One of the most thrilling parts of the *Anabasis,* written by Xenophon, tells of the battle and the gallant retreat of the 10,000 Greeks, after Cyrus's own army had fled in panic.

CZECHOSLOVAKIA, *chek o slo vah' ki ah.* Hemmed in by five other nations, the Republic of Czechoslovakia is located in Central Europe. It came into existence in 1918 as a result of the collapse of Austria-Hungary in World War I. From Austria came Bohemia, Moravia, and Silesia; from Hungary came a large part of Slovakia and Ruthenia. The total area of the new state was 54,244 square miles, and its population was over 13,600,000.

After twenty years of cultural and industrial progress, Czechoslovakia became a victim of the aggression of Adolf Hitler. At the Munich Conference, September, 1938, the Premiers of Great Britain, France, and Italy agreed that the sacrifice of the republic was the only way to preserve peace. To Germany was ceded the Sudeten area along the German border, comprising 11,071 square miles. Poland took 419 square miles of the Teschen area; Hungary seized 4,566 square miles in Southern Slovakia and Ruthenia. The name of Ruthenia was changed to Carpatho-Ukraine. A new Constitution was adopted, making the nation a Federal Republic of three autonomous divisions: Bohemia-Moravia, Slovakia, and Carpatho-Ukraine.

Unable to resist further aggression, the Czecho-Slovak state was partitioned by Hitler in March, 1939, and ceased to exist as an independent nation. German troops invaded the country on March 15. An exiled government, set up in London in 1940, represented the nation until May, 1945, when Czechoslovakia was liberated. In June, the reinstated Czech government ceded Ruthenia to the Soviet Ukraine.

After winning its independence twice in less than thirty years, traditionally democratic Czechoslovakia came under Russian domination at the close of World War II. Few countries have had a more tragic history than has this small, beautiful land, whose area has been whittled down to 49,330 square miles and whose population has been reduced to about 12,500,000.

Cities. Most of the country's large cities are in its western half. Of these Prague (Praha) is not only the largest but also the capital and the leading cultural and industrial center. Other cities include Brno (Brünn), whose textile and other factories account for its being called the "Manchester of Czechoslovakia"; Ostrava (Moravská Ostrava), in the east, noted for its iron and steel products; Bratislava (Pressburg), on the Danube, the country's chief river port; and Plzen (Pilsen), home of the famous Skoda iron and steel works and maker of Pilsener beer.

People. Czechoslovakia is one of Europe's most thickly populated countries. A large majority of the people are native Czechoslovakians, most of whom are Roman Catholics. Others living here are Germans, Hungarians, Russians, Ruthenians, Jews, and Poles.

The country has a state system of education, and teaching is Communist in character. Formerly several languages were taught in most schools because of the mixed population. Now, Russian is the only foreign language regularly taught, though others may be studied as hobbies. Regular and special high schools, trade and theological schools, and several universities are also maintained. Among the universities is the famous Czech University of Prague, founded in 1348.

Industry and Commerce. Some 40 per cent of the people are engaged in agriculture and forestry. The chief farm products include wheat, rye, barley, oats, potatoes, sugar beets, corn, hops (for beer making), flax, vegetables, and fruits. Large numbers of beef and dairy cattle, hogs, sheep, goats, horses, and geese are raised. With its vast wooded areas, Czechoslovakia is one of Europe's largest lumber producers.

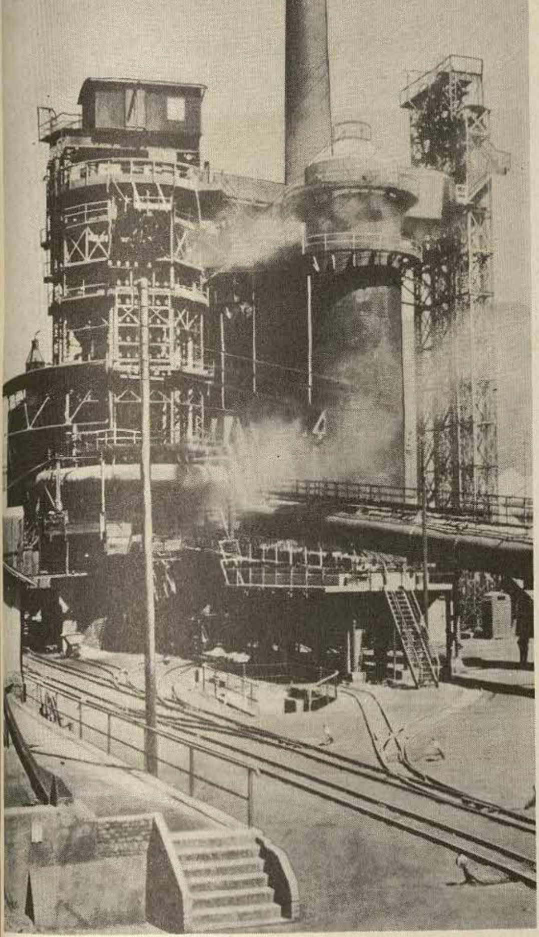
FROM THE STORIED PAST

Castle Pernstejn, in the land of the Czechs, is a picturesque reminder of feudal days. The edifice has been restored.

Rich in coal and iron-ore deposits, the country is a great iron and steel producer. Its other valuable minerals include sand for its fine glass and glassware; kaolin for its excellent chinaware and decorated pottery; silver, gold, copper, lead, rock salt, antimony, magnesite, zinc, graphite, mercury, oil, and gems, especially garnets. From the mines at Jáchymov, in the west, come pitchblende concentrates for producing radium and uranium.

Czechoslovakia normally exports large quantities of industrial products. Besides those already mentioned, its manufactures include shoes, made in Zlín, home of the world's largest shoe factory; textiles; paper; other cellulose products; heavy machinery; munitions; gloves; leather; furniture; chemicals; cement; and processed beverages and foods.

Although an inland nation, Czechoslovakia is connected with the Black and the



Czechoslovak Consulate General; Czech Information Servic

THE "MUSCLES" OF CZECHOSLOVAKIA

The Bohemian blast furnace at right is symbolic of th nation's industrial power. Mass calisthenics (above) are be loved by the Czechs, whose great Sokol festivals are famou

North seas by the Elbe and Danube rivers. It has excellent rail, highway, and airline systems. Most of its trade is with Russia and Russia's other satellites.

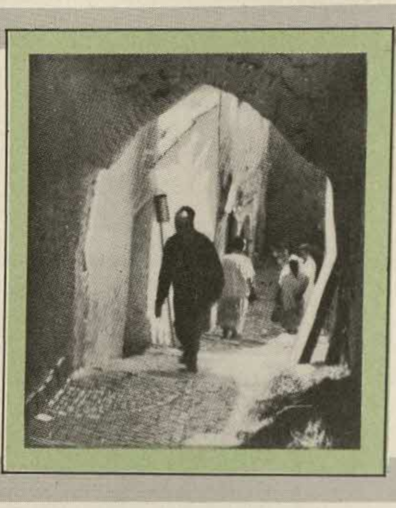
Government. Under its Communist constitution of 1948, Czechoslovakia is a "people's democratic republic," made up of a Czech and a Slovak nation. A one-house National Assembly is the supreme lawmaking body, controls the courts and civil service, and also elects the President, who serves a seven-year term and appoints the Prime Minister and his Cabinet. Provision is made for giving the Slovaks a legislative national council and an executive board of commissioners, but the appointment and recall of the commissioners are subject to the will of the National Assembly.

History. Czechoslovakia was formerly declared a republic on November 14, 1918. Thomas G. Masaryk and Eduard Benes led in the formation of the new nation from the Czech and Slovak lands long ruled by Austria-Hungary. During the administrations of Masaryk, who was President until 1935, and Benes, who succeeded him, the republic progressed rapidly and was both democratic and prosperous.

Nazi Germany descended upon Czechoslovakia in 1939, and the nation suffered cruelly until it was liberated by Russian and American troops in 1945. Benes became President once more, but Russia gradually extended Communist control and in 1948 the patriot leader gave up his post. Czechoslovakia then became a Soviet satellite, with a Communist President, one-party elections, and nationalized industries. It is a member of the United Nations.

For further information, consult:

Austria-Hungary
Benes, Eduard
Bohemia
Germany
Hitler, Adolf
Hungary
Masaryk, Thomas G.
Moravia
Prague
Slovakia



D. The fourth letter of our alphabet was once written like this, ▷. That was in the time of the ancient Phoenicians, who are thought to have meant it to represent a door, originally. The Greeks changed the form slightly and wrote it △, calling it *delta*. But the Romans rounded the Greek form of the letter and made it *D*, the letter familiar to us today.

DACHSHUND, *daḳhs′hoont.* With a body almost three times as long as its height, with short, stubby legs, and a head which resembles that of a sad-eyed hunting hound, this little German dog is the frequent sport of jokesters and cartoonists who liken him to a sausage. The dachshund was originally reared in Europe because he was not afraid to follow the fierce badger into his hole, or to fight him until the hunter could dig the ground animal out. However, because of his amiable disposition, intelligence, and friendliness, the dachshund has become a household pet in both Europe and America.

BRAVE IN HOME AND HUNT
Favorite pet of man—the dachshund.

From his appearance, one can see that his ancestors were the hound and the terrier. He has large, rounded ears which droop, a long, tapering tail, and paws turning out behind. The coat is short and silky, and is usually reddish brown, black and tan, gray and tan, or spotted.

DADDY LONGLEGS. Everyone who has been in the country is familiar with the daddy longlegs. Sometimes called *harvestman,* this spider-like insect has a small, oval body and eight long, brittle legs. These legs are several times as long as the body and may contain as many as fifty joints. The animal emits an unpleasant odor to ward off enemies. Although related to the spider, the daddy longlegs is perfectly harmless.

It feeds on insects and lives but one season. The eggs are laid in the ground in the fall and hatch in the spring. The name is often applied to the English crane fly, but the only similarity is the enormously long legs.

DAEDALUS, *ded′a lus.* The legendary tale of Daedalus and his waxen wings shows how man's imagination has been fascinated by the possibility of flight throughout the ages. According to the ancient myth, Daedalus was the architect who built the famous labyrinth for Minos, king of Crete. In spite of his artistry, however, Daedalus somehow offended the king and was thrown into prison with his son Icarus.

Daedalus soon conceived the idea of making their escape by *flying* away; so for many days the two prisoners trapped birds. When they had collected enough feathers,

THE FIRST "AVIATOR" LOOKS ALOFT
Daedalus fixing his wax and feather wings to the shoulders of his son Icarus. According to the myth, Icarus was killed, Daedalus saved.

Daedalus fashioned two pairs of wings, fixing the feathers together with wax. The legend says that the two took off with the wings working perfectly. Now Daedalus warned Icarus not to fly too close to the sun, lest the heat melt the wax and ruin his wings. But Icarus, heedless of the warning, thrilled to the new experience and flew higher and higher. Suddenly the heat of the sun melted the wax, and the wings came apart. Icarus fell to the earth and was destroyed. Daedalus himself landed in safety, unharmed.

DAFFODIL. See NARCISSUS.

DAGUERREOTYPE, *da gair'o type.* Preceding even the old-fashioned "tintype" of our grandparents, the daguerreotype was the ancestor of the modern photograph. The picture and process are so-called from the inventor, Louis Jacques Mandé Daguerre (1789-1851), a scene painter in a French theater.

The daguerreotype was quite different from a modern photograph, but it achieved the same purpose. It was made with a copper plate coated with silver, which was sensitized by exposure to the vapor of iodine. This plate was put into a crude camera, something like a toy "pin-hole" camera, and the picture taken. The plate was then exposed to vapor of mercury. To fix the image reproduced, the plate was soaked in hyposulphite of sodium, and finally bathed in distilled water.

At the time of its invention, between 1832 and 1839, the daguerreotype was regarded as a marvelous discovery. Daguerre was made an officer of the Legion of Honour and pensioned for the rest of his life. See PHOTOGRAPHY.

GARDEN-CLUB FAVORITE
Beautiful, bright-colored dahlias have long been the hit of flower shows. Here are six of the many varieties which have been developed. The dahlia is a hardy garden flower.

DAHL'IA. Leading the parade of America's popular late-summer flowers is the brilliantly colored dahlia. It is named after

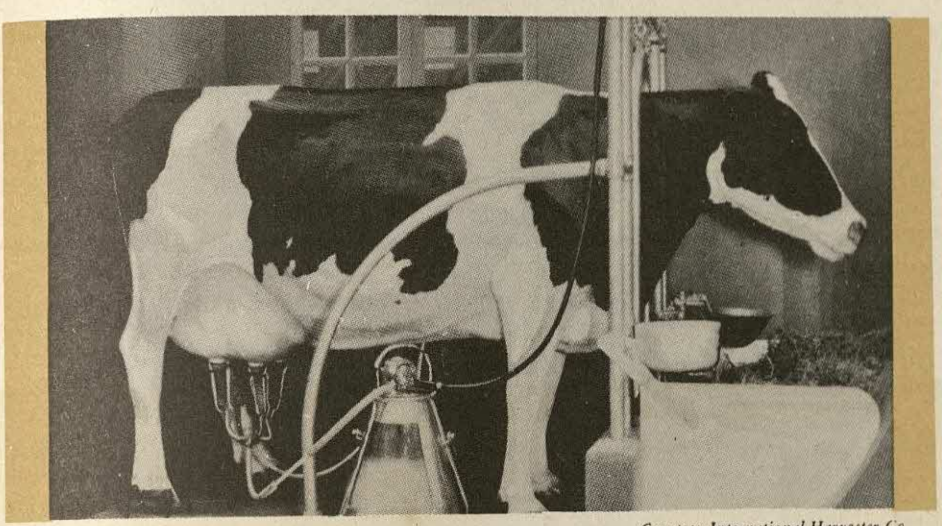
Andreas Dahl, a Swedish botanist. Dahlias vary greatly in appearance and may resemble chrysanthemums, peonies, daisies, asters, or cacti. They grow best in moist, rather sandy soil and are started from tuberous roots set out in the spring. As the bush is bulky, the roots must be planted fully four feet apart. Often stakes are needed to support the plants in high winds, for dahlias attain a height of four to six feet. They bloom in the fall. They can resist a light frost. If heavy frost kills the bush, it should be cut off, and the root bulbs dug up and stored for planting until the following spring.

DAHOMEY, Republic of, is a republic located on the Gulf of Guinea. It was formed from French West Africa. It is bounded by the republics of Togo and Niger; Nigeria and the Gulf. It became independent August 1, 1960. Its area is 45,900 square miles and its population is about 1,713,000. Its capital is Porto Novo. It had been self-governing since 1958.

courtesy Creamery Package Mfg. Co.

DAI'RYING. Milk, butter, and cheese are three important foods, and it is the production of these foods with which dairying is concerned. Until the latter half of the nineteenth century, however, dairying in the United States and Canada was confined almost entirely to the needs of individual farmers. Moreover, it was limited chiefly to the pasture seasons. But during the past fifty years and more, a steady supply of milk has been maintained the year around, new methods of handling and distribution have arisen, and new uses have been found. Milk today, more than ever before, has come to be indispensable to health.

Not only does the health of the babies of America depend upon milk, but milk has assumed an important place on the table as a nutritious drink for the whole family. All milk contains calcium, needed by growing children in building sturdy bones and teeth; calcium is almost as essential to adults. Milk is used in making butter, cheese, condensed milk, and ice cream; it is used daily in the cooking of other foods. It has no rival; it is the world's greatest all-around food, containing every needed element for health. Cheap and plentiful though it is, a city is almost panic-stricken if the milk supply is cut off for a single day.



Courtesy International Harvester Co.

FOR CLEAN MILK, CONTENTED COWS, EFFICIENT FARMERS

Milking machines have taken the place of the milk pail and stool on many big dairy farms, chiefly because they are more sanitary. They work by suction, and cows soon become accustomed to their regular mechanical action. There are no nervous cows when this method is used.

The Modern Dairy Farm. The great supply of milk for cities comes from modern dairy farms located usually within a radius of two or three hundred miles of a city. Such farms are operated by men who know the business, who select their herds carefully with an eye to both quality and amount of milk, and who know how to care for a herd.

Except in the pasture season, dairy herds are kept in specially constructed cow barns. Concrete floors, whitewashed walls, and good light and ventilation combine to make the barn sanitary. Flies are eliminated, floors are kept clean and fresh straw is spread daily. The cows are in movable stanchions along two sides of the barn, and are fed hay and a balanced ration of ground feed to maintain a plentiful flow of milk. In the summertime, cows are pastured daily, for no food is more desirable than grass for producing milk.

The milking is done by machine or by men dressed in spotless white suits. Every care is taken to keep the milk clean and pure. It is strained and cooled immediately after milking and is then put into large cans for delivery to the nearest railway, to be picked up by special milk trains speeding toward the city. In many places, trucks pick up the milk at the farms and haul it to the cities.

Distribution. Arriving in the city, the milk goes immediately to dairy plants where it is again strained, pasteurized to kill any harmful bacteria present, and separated. After separation, cream is added to the milk to bring it up to the city standards; the remainder of the cream is bottled and sold as coffee cream or whipping cream. Newer methods provide also for the bottling of extra-rich grades of milk and the injection of vitamins into the milk. The bottled milk is thoroughly chilled, crated, and loaded into wagons and trucks for delivery throughout the city.

Much of the raw milk goes to creameries for the making of butter, or to cheese factories for the manufacture of many kinds of cheese. The making of cheese and butter is usually handled in local plants near the dairy farms, as is the manufacture of condensed and powdered milk. Most of the cheese or butter plants require the milk from 300 to 500 cows daily. Condensed and powdered milk, widely used dairy products, are sold to wholesalers and jobbers throughout the country, who in turn supply the retailers.

Some of the milk supply of the country now goes to ice-cream plants, where thousands of gallons of this favorite product are made daily.

Two of the by-products of the dairy industry are skim milk and whey. Both are valuable foods for poultry and hogs.

It is the milkman who goes from door to door every day to deliver milk to householders. He is confronted with the problems of keeping milk from freezing in the winter, keeping it cool in the summer, and striving to keep his customers in spite of competition.

Several improvements have added to the efficiency of distribution. Chief among these is electric refrigeration, by which milk is kept sweet for days. There are, besides, the increasing use of milk powder and of frozen concentrated milk; lightweight containers, which eliminate the necessity of hauling "dead-weight" cases and bottles; and the new idea of daylight delivery to customers.

Between farm and city, many improvements in sanitation have been effected by greater speed of trains and trucks, glass-lined tank trucks and cars, increased sanitation in the dairy, and better refrigeration on the farm.

Safeguarding Health. Many of the advancements in the dairying are due to laws passed to protect the public. Strict dairying laws providing for sanitation in the dairy barn and in milking, state tuberculosis tests of herds, strict laws as to the handling and distribution of milk products, and legislation regarding a minimum-cream content are examples of progress made in the milk industry.

Milk Production in the United States. Wisconsin far outstrips the other states in milk and cheese production. In average years, its milk production has been over 1,200,000,000 gallons—more than a tenth of the total annual production of milk in the entire United States. New York and Minnesota rank next, producing every year on an average of about 810,000,000 gallons each. In the production of butter, Texas usually ranks high, with an average yearly output of over 83,000,000 pounds; this is about twice as much butter as any other state produces in a single year. The United States as a whole produces annually over 2,000,000,000 pounds of butter.

Lowering the retail price of milk and its products cannot be brought about by a cut in the farmer's share; he is already receiving a small fraction of the retail price. Such reductions must be brought about by greater efficiency on the part of the city distributor and manufacturer through research.

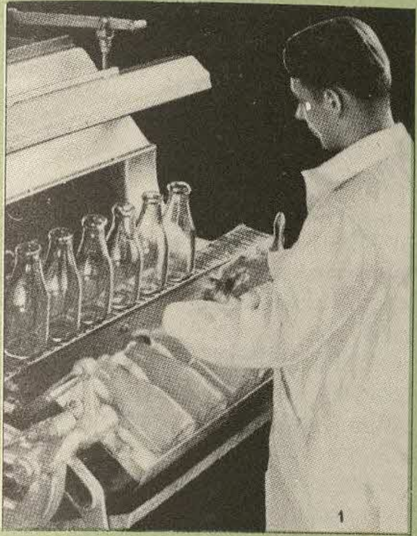
Consult the following titles for additional information:

Agriculture
Butter
Cattle
Cheese
Churn
Creamery
Cream Separator
Milk
Milk, Condensed
Silo and Silage

Courtesy National Dairy Council and International Harvester Co.

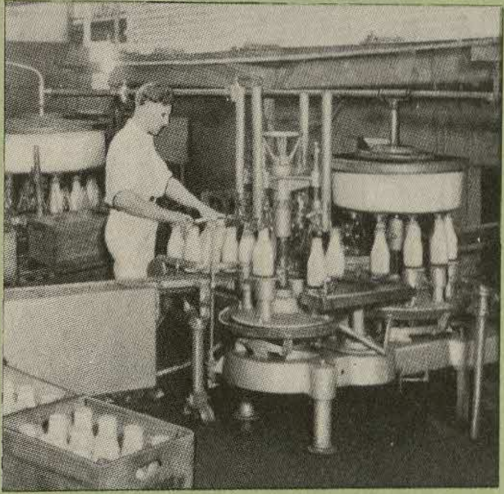
MODERN DAIRIES ARE SPOTLESS

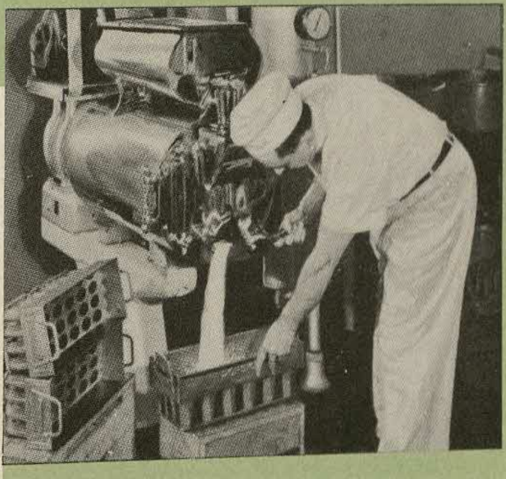
Up-to-date farms have rows of immaculate stalls and well-kept concrete floors (above), to insure absolutely clean, safe milk. And to keep milk fresh, power coolers (right) are used.


1

2

3





All Photos courtesy Creamery Package Mfg. Co.

THE DAIRY "ASSEMBLY LINE"

Among the most progressive of industries, dairying utilizes the most modern equipment. (1) An automatic bottle washer, cleaning and sterilizing six at a time. (2) The latest in pasteurizers—those life-saving purifiers of our milk. Milk in these tanks is heated, agitated, and cooled according to a system which kills dangerous bacteria. (3) An improvement on Nature—the milk irradiator. As the film of milk spins around the tank walls, the glowing arc in the center charges it with Vitamin D, which prevents rickets in children.

OX-EYES IN THE MEADOW
Up-turned daisy faces grow by the million in our fields and meadows, although they were originally natives of Europe. Daisies belong to the composite, or sunflower, plant family.

DAISY. Handsome, hardy flowers of the composite family, daisies are found over wide areas in both Canada and the United States.

The daisy, which belongs to the chrysanthemum genus, has but one blossom on each stem, comprised of a single row of white petals radiating from a central disc of yellow or brown. Best known of the numerous kinds of daisies are the common *white field* daisy, the *oxeye* daisy (also called the *marguerite*), and Burbank's famous *Shasta* daisy, a large and lovely variety developed after years of effort (see BURBANK, LUTHER). Double daisies in many colors have also been developed for gardens. The daisy symbolizes simplicity and modesty. It is often called the flower of April.

Though cultivated in many flower gardens, the daisy is a "pesky weed" to the farmer. A tough, hardy perennial, it is a real problem because it chokes out valuable crops.

DAL'LAS, TEX. In the heart of one of the richest agricultural regions in the world is Dallas, the largest city in Northern Texas. It is located on the Trinity River, thirty-one miles east of Fort Worth. Its rapid development, especially since the first World War, has made it the most important financial and commercial center of the state, and with its many skyscraper buildings and thriving factories, it has a truly metropolitan appearance.

Dallas is America's largest inland cotton market and manufactures more cotton-ginning machinery than any other place in the world. Many large oil companies also have their headquarters here, and oil refining is one of the city's chief industries. Other important ones include the manufacture of saddles and other leather goods, textiles, aircraft, batteries, women's clothing, cement, cottonseed products, chemicals, furniture, paper, flour, iron, and machinery; publishing and printing; and meat packing. The city is one of the United States' largest insurance-company headquarters and is the Southwest's top wholesale and fashion center. The Federal Reserve Bank of the Eleventh District is here, as are Hensley Field, a United States Air Force base, and a naval air-training station. Dallas is a leading air, rail, bus, and highway hub of the Southwest and the chief shipping center for a vast region.

The city's educational institutions include Southern Methodist University, Southwestern Medical School of the University of Texas, and Baylor University's dentistry and nursing schools. Dallas is also noted for its "Cotton Bowl" stadium, aquarium, parks, museums, symphony orchestra, and annual state fair.

The city was started when John N. Bryan built a log hut on the banks of the Trinity River, in 1841. The settlement was known as Peter's Colony until 1845, when Texas was admitted to the Union. In that year the name was changed to Dallas in honor of George Mifflin Dallas of Philadelphia, newly elected Vice-President under Polk. The place was incorporated as a city in 1871, and by 1890 was the largest city in the state. In 1931 Dallas adopted the city-manager plan of government. Under this plan the voters elect a council of nine, who appoint one of their members to act as mayor for a term of two years. The population is about 679,000.

DALMATIA, *dal ma' shih uh.* Hemmed in between the Adriatic Sea and the snow-covered Dinaric Alps, Dalmatia is a narrow strip of coastal land, now included in Croatia, one of the federated republics that make up Yugoslavia. Its area is about 5,000 square miles, and it has a population of about 900,000. The long, narrow mainland of Dalmatia owes its spectacular beauty to the fiordlike bays formed by rugged spurs of the Dinaric Alps. There are hundreds of offshore islands.

Most of the people are engaged in fishing, in raising cattle, sheep, and goats, and in growing fruits and vegetables. Manufactures include olive oil, glass, cement, chemicals, wines, and liqueurs, especially maraschino. Split (Spalato), Zadar (Zara), and Dubrovnik (Ragusa), the major cities, are known for their good harbors and for shipbuilding.

Dalmatia was colonized by the ancient Greeks, ruled by the Romans, and invaded by Goths, Byzantines, and Slavs. In the eighteenth century the region was held in turn by Turkey, Austria, and Napoleon's Kingdom of Italy. In 1815 it became a crownland of Austria-Hungary, but at the close of World War I nearly all of it was ceded to Yugoslavia. Italy lost possession of Zadar and several Adriatic islands in World War II. See CROATIA AND SLAVONIA; YUGOSLAVIA.

DALMATIAN. Often called the "coach dog," the medium-sized, spotted Dalmatian may have originated in the old province of Dalmatia. It got its nickname in horse-and-carriage days, when it was often seen running between the rear wheels of its owner's coach. It is a popular pet.

United Air Lines Photo

BIRD'S-EYE VIEW OF BOULDER DAM
It created the world's largest man-made lake.

DAM. City dwellers seeking an adequate water supply, and industries and homes needing cheap electrical power are coming to rely more and more upon dams to supply their wants. Businessmen looking for better transportation facilities, farmers desiring more land to till, and inhabitants of great river valleys, anxious for protection from floods, also find an effective solution of their problems in dams.

These man-made structures hold back rivers in order that water may gush through great turbines for the generation of power. They form vast reservoirs and artificial lakes which store water for crowded cities and arid farm lands. They eliminate shoals and shallows, permitting boats to navigate over previously impassable stretches of many of the world's streams. And they help ease the flow of flood waters.

Types of Dams. Man has copied the industrious little beaver in the construction of the earth dam, one of the two main types. Ranging in size from a small mound across a farm creek to the huge Fort Peck project in Montana, the earth dam is probably the oldest type, originating centuries ago when men first began to irrigate the soil. The earth dam is built with an inner core of puddled clay, concrete, or other impervious substance as a nucleus. On the upstream side, the earth is filled in at a fairly steep slope, while the downstream side is on a more gradual incline, forming a buttress. The inner surface is usually composed of rock, and the outer surface of earth and grass. The grass is essential since it prevents the earth from being washed away by the action of the water. Engineers attempt to build earth dams on a solid base, for loose gravel, quicksand, or clay will slip or otherwise fail, causing a collapse.

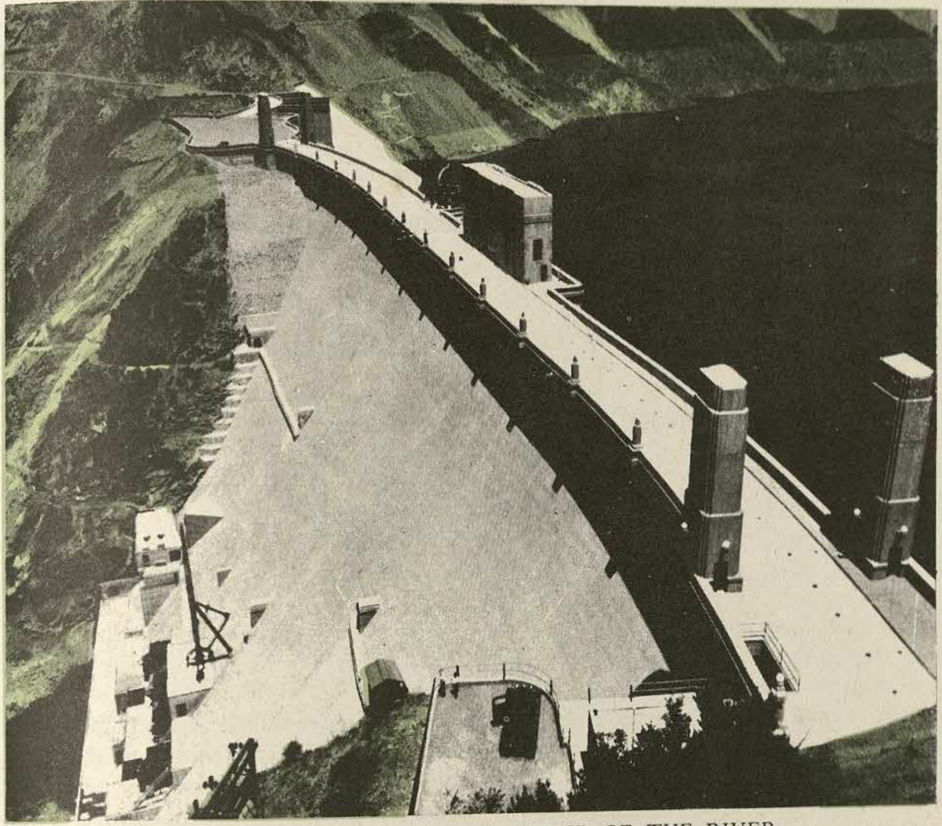
Some old-fashioned dams, built with masonry abutments and timber faces, are still in service, but they require constant repair because of timber rot, ice damage, etc., and are consequently becoming obsolete.

Masonry dams are more expensive to build, but they have been found necessary for impounding swiftly moving streams. Rock and stone are sometimes used for smaller masonry dams, but the modern larger ones are constructed with reinforced concrete. As to shape, a dam may extend in a straight line across the stream or it may be curved in an arc, depending on the location and the nature of the river. For instance, Boulder Dam, built across the turbulent Colorado River in a narrow canyon, is a curved dam, while Wilson Dam, across the Muscle Shoals section of the Tennessee River, is straight. In the case of curved dams, the convex side faces the stream, so that the force of the current meets the load-sustaining side of the arch. The upstream side in both curved and straight dams is usually vertical, while the downstream side slopes, the base being considerably wider than the top.

Engineering Problems. The building of concrete dams has tested the ingenuity of engineers, and, in the past few years, many important advances in construction have taken place. One of the difficulties overcome recently is the problem of the cooling of concrete. When large masses of the substance are poured, heat is produced by the chemical action which takes place as the concrete sets. In the case of Boulder Dam, it would have taken years for the great mass of concrete to cool and solidify had it not been cooled artificially by cold-brine pipes.

In building all dams, engineers must compute accurately the force of the water; they must study the foundations on which the structure will rest; and they must determine the width of the base, the thickness at the top, and the height exactly, in order that there will be no failure. Should a large dam break, a catastrophe might ensue, as in 1889, when a large earth dam on the Conemaugh River in Pennsylvania broke. Many persons in Johnstown, twelve miles below the dam, were drowned, houses were swept away, and millions of dollars' worth of damage was done by the terrific wall of water that burst through the break in the dam.

Some Notable Dams. One of the most famous dams in the world is the beautiful marble structure in Rajputana, India, built by Rana Raj Singh about 1661. This dam



HARNESSING THE MIGHTY POWER OF THE RIVER

Dams tame the wild rushing waters, turn their energy into electricity, and use the water itself to supply cities and irrigate desert land. Probably man's oldest power device, dams now produce millions of horsepower. Above is the Morris Dam in the Pine River, in California, which creates a whole new farming region and augment s Pasadena's water supply, besides producing power.

has been extremely useful in irrigation.

Man is building mighty dams all over the world to provide power, irrigate land, and control floods. Japan has the Kurobe projects on the Kurobe River. Among others, Red China is building the Sanmen Gorge project on the Yellow River. India's great Bhakra Dam on the Sutlej River is nearing completion. It has many other large dams. Huge hydroelectric developments completed or under construction in Russia are the Krasnoyarsk on the Yenisei River, Lenin on the Volga near Kuibyshev, and Bratsk on the Angara River. Kariba Dam on the Zambezi River in Africa has started supplying electricity. Construction has begun on the High Assuan (Aswân) Dam on the Nile in Egypt. Great dams in Europe include the Grand Dixence and Mauvoisin in Switzerland, the Vajont in Italy, and Tignes in France. The United States is making greatest possible use of its great rivers. Twenty dams have been built on the *Tennessee River* since 1933. Dams on the *Columbia River* include Grand Coulee, McNary, The Dalles, John Jay, Bonneville, Priest's Rapids, Wanapum, and Rocky Reach; *Colorado:* Glen Canyon, Hoover, Flaming Gorge and Navajo; *Snake:* Brownlee, Ice Harbor, and Oxbow; *Missouri:* Oahe, Fort Peck, Garrison, Fort Randall, and Given's Point. California's Central Valley project has Shasta and Friant dams; its Feather River project will

WORLD'S HIGHEST DAMS

NAME	LOCATION	HEIGHT (in feet)
GRAND DIXENCE	SWITZERLAND	940
VAJONT	ITALY	872
MAUVOISIN	SWITZERLAND	780
BHAKRA	INDIA	740
HOOVER	UNITED STATES	727
GLEN CANYON	UNITED STATES	700
KUROBE	JAPAN	630
SHASTA	UNITED STATES	602
TIGNES	FRANCE	592
KARADJ	IRAN	590

WORLD'S LARGEST DAMS

NAME	LOCATION	VOLUME OF MATERIALS (in cubic yards)
FORT PECK	UNITED STATES	130,421,000
OAHE	UNITED STATES	79,000,000
GARRISON	UNITED STATES	67,500,000
TRINITY	UNITED STATES	33,200,000
FORT RANDALL	UNITED STATES	28,000,000
HIRAKUD	INDIA	27,000,000
KINGSLEY	UNITED STATES	26,000,000
NAVAJO	UNITED STATES	26,000,000
GATUN	PANAMA CANAL ZONE	23,000,000
TUTTLE CREEK	UNITED STATES	20,000,000

U.S. Dept. of the Interior

have the huge Oroville Dam, and Trinity Dam. There are many dams on the southern Atlantic seaboard.

For further information consult:

Assuan
Bonneville Dam
Boulder Dam
Grand Coulee
Irrigation
Reclamation
Tennessee Valley Authority
Water Power

DAMAS'CUS, Syria. Probably the world's oldest still-inhabited city and often mentioned in the Bible, Damascus is beautifully located. Fringing the Barada River, it lies at the foot of the Anti-Liban (Anti-Lebanon) Mountains and at the edge of an oasis, where lushly green groves and gardens form a delightful contrast to the tawny sands of the surrounding desert.

Once a center of Christianity but long a holy Moslem city, Damascus is famous for its many mosques, whose graceful minarets rise above its narrow, crooked streets. Also famous are the Oriental bazaars, bustling with activity, where local, desert, and foreign products are exchanged. One of the Near East's greatest manufacturing and trading centers, Damascus is further noted for its beautiful jewelry and other metalwares; silk and cotton goods, especially handsome damasks; leatherwork; inlaid-wood articles, including furniture; and porcelains and glassware. It is connected with Beirut, Lebanon, its port, by air, rail, and highway.

Although few of the ancient city's historical buildings are left, the "street which is called Straight," mentioned in the Bible (Acts 9:11), is still there — roofed over and lined with crowded bazaars. Except in the rich Moslem section, the houses are drab-looking, but some of them shelter wealthy families and rare art treasures.

At least 5,000 years old, Damascus has been ruled by the Assyrians, Egyptians, Persians, Macedonians, Romans, and others. It was often attacked during the Crusades and was under Turkey from 1516 until 1918. The capital of Syria, it has about 400,000 residents. See Damask; Syria.

DAMASCUS STEEL. Justly proud was the knight of old whose trusted sword was a Damascus blade — made of the toughest, sharpest, most flexible steel in the world.

It could slash through the hardest ordinary sword, and yet its lightest stroke could slit the softest silken pillow in two.

The armorers who forged this marvelous steel first worked in the ancient city of Damascus, whence the name of the metal. But their art eventually spread to other Oriental cities. Now the anvils of these craftsmen are silent, and the making of Damascus steel is a lost art.

DAMASK, *dam'usk*. Damascus, the ancient Syrian city, famed in the Middle Ages for its wonderful silken fabrics, gave its name to this type of cloth. Originally, the name *damask* was given to a class of elaborately figured silk fabrics, but now is applied to silk, linen, or cotton fabrics ornamented with flat figures which are formed by the contrast between different interlacings of the warp and filling threads. If the background is formed by one kind of weave structure, the figure or design is brought out by the use of either a different weave structure or the same weave at right angles to the first. The design and background reflect the light differently; this fact explains why the figure in a white linen tablecloth stands out clearly.

Table damask is the term now used to mean fine table linen (which may be all linen, mixed linen and cotton, or mercerized cotton, and woven either figured or plain). Very fine quality is called *double damask,* and has a firm, leathery feel, owing to the close weaving of a large number of threads to the inch. It is woven by the yard, plain, or with a continuous repeating pattern, or as napkins with a completed pattern and border.

DAMON, *da'mun,* **and PYTHIAS,** *pith'i as*. There lived in ancient Syracuse, in Sicily, two devoted friends, Damon and Pythias. So great was the friendship of these young men that each was ready to give his life for the other.

One day Dionysius, tyrant of Syracuse, became angry with Damon and unjustly condemned him to death. But Damon could not die before he had arranged some important affairs; so he begged for a few days' time. Pythias then said to Dionysius:

"Give Damon his wish. If he does not return at the appointed time, you may execute me instead."

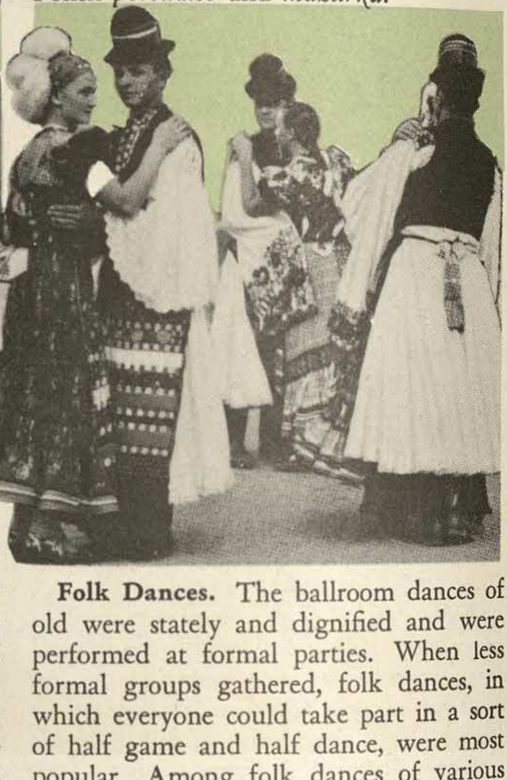
So the king granted Damon's request. This meant that Damon could, if he liked, escape and leave Pythias to die in his place. But he was true to Pythias' trust, and returned in time.

This proof of deep friendship so touched the king that he pardoned Damon and released both the young men. Their names are used today as symbols of enduring friendship.

All mankind dances, whether to tom-tom or swing band. Here is the tom-tom variety, as performed by American Indians in full regalia.

DANC'ING. As a means of expression by graceful motion of the body, dancing is one of the oldest arts of man. People all over the world find beauty and pleasure in dancing, usually to the accompaniment of music.

In ancient times, religious ceremonies were celebrated by dancing, and in the Orient the ceremonial dance is still a part of many non-Christian religious services.



Courtesy Cunard-White Star, Ltd.

THE NATIONS DANCE

Rhythmic expression takes thousands of forms, and while many of these are purely social, a large number have religious significance. Such is the temple dance of the Burmese girls (above). Hungary's peasant *czardas* (right) is a social dance form.

The Zuñi Indians of New Mexico annually perform their rain dance to end the dry season. To express rage, the natives of primitive countries have their war dances. The ferocious war dances of the North American Indians were dreaded by the pioneers. As an artistic expression, the dance is also used in Greek drama and modern opera to assist in telling the story. Complete stories, too, are related in dance pantomime by solo dancers and ballet groups.

Ballroom Dances. France has led in inventing ballroom dances. The French adapted the favorite dances of neighboring countries and introduced them at their parties. Some of these dances were the graceful *minuet,* popular also in England and the American colonies; the *quadrille,* much like a game, but with the graces of the minuet; the *lancers,* introduced by Laborde in Paris in 1836; the *polka* and the *schottische,* brought from Bohemia; the *galop,* originally a German dance; and the *waltz,* most enduring of all the ballroom dances. The waltz reached its highest development in Germany. There the great composers, particularly the members of the Strauss family, wrote such beautiful music for the waltz that few could resist dancing. Other favorite dances were the Polish *polonaise* and *mazurka.*

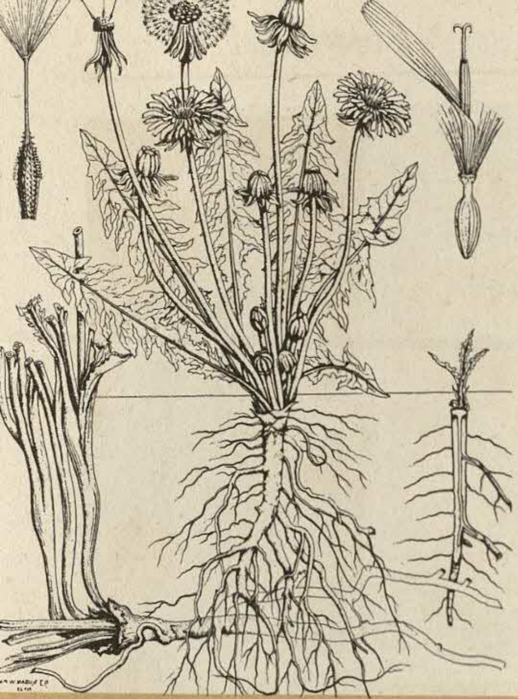
Folk Dances. The ballroom dances of old were stately and dignified and were performed at formal parties. When less formal groups gathered, folk dances, in which everyone could take part in a sort of half game and half dance, were most popular. Among folk dances of various countries, a few that are well known are the Scotch *reel* and *Highland fling;* the Irish *jig;* the *Virginia reel,* called the *Sir Roger de Coverley* in England, and only one of many "country dances"; and the American *barn* or *square* dances. Recently, new interest has been found in these folk dances. In communities throughout the United States, people are dancing the Virginia reel, the Paul Jones, and other "sets" of the old barn dances, to the merry tunes of fiddles.

American Ballroom Dances. Since the beginning of the twentieth century, Americans have found pleasure in a number of new and different dances. An American

Even the powerful Napoleon had to learn the waltz when it became popular (upper right). Left, the American couple who originated modern ballroom dance styles—Irene and Vernon Castle—shown demonstrating the tango at the height of their career. Right, a Russian interpretive dancer whose movements express the mood of the music. This is today's version of the Ceremonial dance.

dance band, a smooth floor, and a graceful partner combine to interest people in new variations and different arrangements of dance steps. Styles and fads in dancing have come and gone almost as rapidly as have changes in women's fashions. Among the earliest fads was the *turkey trot,* introduced in San Francisco early in the present century.

But these dance fads are more talked about than danced. Here and there a couple is given enough room on the dance floor to try them, and entertainers sometimes use them in their stage acts. Generally the more quiet, less fatiguing dances are most favored. The *fox trot,* the *one-step,* the *tango* (adapted from the Argentine national dance), the *hesitation,* the *waltz canter,* and the old-fashioned waltz are the popular dances for which modern dance music is written. Radio broadcasting stations devote much of their time to the music of orchestras playing in ballrooms and hotel dining rooms; and few American parties, even in private homes, are complete without dancing to this music.



U.S.D.A.

GOLDEN ENEMY OF THE LAWN
Every puff of wind scatters scores of seeds.

DAN'DELION. One of the familiar sights of early spring is the bright yellow and green carpet formed by dandelions on a lawn. The dandelion is a member of the composite family. Its flowers are borne singly on hollow stems. The toothed leaves give the plant its name, which comes from the French for *tooth of a lion*. When the flowers mature they become white balls of feathered fruits. These are blown far and wide by the wind, and only ugly seed stems are left to disfigure the smooth lawns of careful gardeners, who consider the dandelion an objectionable weed.

Young dandelion leaves can be used for salads or as greens. The plant is filled with a bitter, milky juice, and the roots of some species have medicinal properties.

DAN'IEL. See Bible Stories.

DANTE ALIGHIERI, *dahn'ta ah le gya're* (1265-1321). The most famous of Italian poets, Dante Alighieri was born in the city of Florence of a family which probably belonged to the lesser nobility. He was educated in accord with the highest standards of the times. Not only did he become well versed in theology, law, and languages, but he also joined in the awakening interest in literature, music, painting, and science. His great poems reflect his mastery of the knowledge of the day.

Dante was also interested in political affairs and accepted several responsible public offices. There was, however, bitter strife between the rival factions of the Neri, or Blacks (the extreme supporters of the Pope), and the Bianchi, or Whites (the more moderate party). When the Neri gained control of the city in 1302, Dante was exiled, together with the other leaders of the Bianchi. He never returned to Florence, and died in Ravenna in 1321. A number of cities throughout Europe have claimed the honor of having been visited by the poet during his wanderings. It was during his exile, apparently, that he composed the famous *Divine Comedy,* for which his name has been placed among the greatest writers of all time.

The three best-known works by Dante, the *New Life,* the *Banquet,* and the *Divine Comedy,* tell the story of Dante's own life and describe the conditions, events, and people of the period. In the *New Life* is the story of Dante's meeting and falling in love with Beatrice when they were both nine years old. Though Beatrice later married another, and Dante married Gemma Donati, his love for Beatrice was the inspiration of all his writings. He succeeded in immortalizing Beatrice and his love in the *Divine Comedy.*

The Divine Comedy. Dante wrote that the *Comedy* was intended to be the allegorical, or figurative, story of man, "how by merit or demerit he justly deserves rewards or punishments." The story is told in an imaginative description of the condition of souls after death. It was called a comedy because it begins with tragedy but ends in happiness. The *Divine* was added by admirers more than three centuries later.

In the story of the poem, Dante takes an imaginary journey through hell, purgatory, and paradise. While he is wandering in a dark forest, the shade of the Latin poet

THE GREATEST FIGURE IN ITALIAN LITERATURE

Dante Alighieri, the writer of the *Divine Comedy*, ranks among the world's immortals of literature. Left, Dante catches a glimpse of his beloved Beatrice. Right, a memorial statue of the poet.

Vergil appears and offers to guide him through hell and purgatory. In the awful depths of hell, they see the horrible punishments with which sinners are inflicted for all eternity. Those sinners who were guilty of only ordinary sins and who repented are found in purgatory. Punishment is as severe there as in hell, but it is temporary.

At the gates of paradise, Vergil must return; but in the heavenly gardens, Dante is guided by his beloved Beatrice. In the nine spheres of heaven, Dante describes with awe-inspiring beauty the wondrous rewards for the noble and pure, and for those who suffered unjust wrongs on earth.

Several hundred editions of the *Divine Comedy* have been printed, and it has been translated into many languages. The original poem was written in the native language of Tuscany, the origin of modern Italian.

DANT'ZIC. See Danzig.

DAN'UBE. Famed in legend, music, and history, the Danube is the most important water route of commerce and communication in Europe. Originating in the Black Forest, the river flows for 1,750 miles in its variable easterly course through the heart of Europe to the Black Sea, and is the water highway and trade route for many nations. About sixty navigable rivers empty into the Danube, which, with its tributaries, drains an area of approximately 300,000 square miles; and it is the second largest river in Europe, ranking next to the Volga.

Along its banks are located some of the largest industrial and commercial centers of Central Europe. At Ulm, in Southern Germany, the Danube is navigable for small boats, and small steamers sail to Regensberg. Other Danubian ports include Passau, also in Germany; Linz and Vienna, Austria; Bratislava, Czechoslovakia; Budapest, Hungary; Belgrade, Yugoslavia; and Galati, Rumania.

Beyond Belgrade, the Danube flows southward and eastward to form the boundary between Rumania and Yugoslavia, Bulgaria and Rumania. On the Rumanian-Yugoslavian boundary, the Transylvania Alps nearly close in upon the river, and shallow rapids formerly prevented navigation. This narrow pass, called the Iron Gate, was opened by blasting and

RIVER OF SONG AND STORY—THE BLUE DANUBE

Winding down from Southern Germany through Austria and the Balkan States, the Danube passes many a historic and romantic spot. It flows through many of the world's great cities, and besides being beautiful, ranks as one of the most important of commercial waterways.

excavations, so that the river is now constantly navigable.

At Ruse, on the Bulgarian-Rumanian boundary, the Danube takes a northward course; flowing through the lowlands and marshes, it soon reaches a width of more than a mile, pursuing its three ways to the Black Sea. More than a hundred miles inland are Braila and Galati, which are its two great seaports. One of the river's deltas has been dredged and widened so that large ocean steamers are accommodated. Ludwig Canal in Bavaria connects the Rhine and the Danube and greatly increases the Danube's navigable miles.

Realizing the vital importance of the Danube as the life stream of commerce, the nations of Europe, in 1856, created the European Commission of the Danube, under whose direction many of the improvements in the channel were made. By the Treaty of Versailles, a new commission to supervise the river's navigation was formed in 1920.

Flowing through forested regions, traversing great plains which produce most of Europe's grain, passing over rocky plateaus and mountain ranges, and across marshes dotted with low islands, the Danube is stately, picturesque. In some sections along its course, the river rivals the Rhine in beauty and dignity of scenery, and it inspired Johann Strauss to write the ever-popular waltz, *The Beautiful Blue Danube.*

DANZIG, *dahn'tsik*. Lying at the mouth of the Vistula River, Danzig has for centuries been an important Baltic port. It is a picturesque city which still has, to a great extent, the atmosphere and appearance of medieval times. Quaint old gabled houses built centuries ago are still standing.

Danzig is an old city, its historic interests dating from the tenth century. In the Middle Ages, it was an important member of the Hanseatic League. It became part of Poland in 1455, but after the second partition of Poland was ceded to Prussia.

As provided for by the Versailles Treaty in 1920, Danzig was taken from Germany and the "Polish Corridor" created. So that Poland could have a port on the Baltic, the Free City of Danzig, comprising the city of Danzig proper and surrounding territory on the Baltic Sea, was set up and declared an independent state under the protection of the League of Nations. The Free City of Danzig had an area of 754 square miles and a population of about 412,000, most of whom were Germans.

Germany absorbed the Free City of Danzig in 1939; the city proper became a German port, and the territory surrounding it became part of the German Reich. In 1945, the Polish Corridor and the Free City of Danzig were returned to Poland. The city now has about 270,000 residents. See HANSEATIC LEAGUE; POLAND.

THE DARDANELLES AREA

Although Turkish troops occupy this strategic area, it is kept neutral by international agreement.

DARDANELLES, *dahr da nelz',* THE. Part of the international boundary between Europe and Asia is the Dardanelles, a narrow channel connecting the Sea of Marmora with the Aegean Sea. The ancient Hellespont, the narrowest point of the Dardanelles, was the scene of the story of Hero and Leander. There Xerxes built his bridge of boats, and there Alexander later crossed. Forty-seven miles long and one to four miles wide, the Dardanelles has a swift current coursing through its narrow, rather shallow channel.

Control of the strait has influenced world history; when the Turks won absolute authority over it near the end of the fifteenth century, the fate of the Byzantine Empire was sealed. Today, the command of the Dardanelles is of prime concern to the countries of Europe and Asia Minor. From the middle of the nineteenth century to World War I, treaties between the five great powers (England, Germany, France, Russia, and Austria-Hungary) guaranteed that no foreign warships would enter the strait without Turkey's permission, although Russia tried to have access to its ports on the Black Sea.

During World War I, the Allies tried to gain control of the Dardanelles, so that their men-of-war could attack Constantinople. As the strait is easily defended, Allied fleet bombardments and army attacks on the Gallipoli Peninsula were repulsed. After nearly a year of futile efforts at great financial and human life cost, the Allies withdrew.

The Dardanelles was held by the Allied nations from the close of World War I to 1920, when it was placed under international control. The Montreux Convention, signed in 1936, permitted Turkey to remilitarize the area from the Dardanelles to the Bosporus (which see). The treaty permitted the passage of warships only in peacetime. See TURKEY.

DARI'US I (about 550-485 B. C.). The ancient Persian Empire reached its most complete organization under the able rule of Darius, called "the Great." During his reign, which began in 521 B. C., the empire was divided into satrapies or provinces, each which was governed by a satrap. Taxes were uniformly regulated and a system of coinage was established. Commerce flourished throughout the East, encouraged by excellent roads and a postal system, the speed and completeness of which were surpassed only in modern times.

The Persian Empire was extended and its sovereignty strengthened in a number of military campaigns. A few cities revolted, among them the city of Babylon, but they were successfully subdued. However, an expedition of 700,000 against the

TWILIGHT OF AN EMPIRE—THE DEATH OF DARIUS III
The conquering Alexander standing over the dead Darius, last Persian king.

Scythians on the Danube was not very successful. The Greeks and Ionians also began a struggle to win independence, and to quell the revolt, Darius sent a fleet and land forces against them. The attempt was abandoned after the ships were destroyed in a storm near Mount Athos (492 B. C.).

A second expedition, led by Datis, bowed to the Athenian army in the famous battle on the plains of Marathon, in 490 B. C. Before a third army against the Greeks could be made ready, Darius died, in 485 B. C. See MARATHON.

DARIUS III. The Persian Empire was in a state of decay when Darius III became the twelfth and last king, in 336 B. C. Weakened by the luxury and tyranny of the satraps, or governors, Persia was in no condition to resist the determined attacks of Alexander the Great. The Persians first met defeat on the banks of the Granicus, in Asia Minor. Darius himself then led the army in the mountainous region of Cilicia; but Alexander was victorious at Issus, and again at Arbela, in 331 B. C. Susa, the capital city, and Persepolis were captured, and all Persia was reduced. Darius escaped to the east, where he met his death in a traitorous conspiracy, in 330 B. C. See ALEXANDER THE GREAT.

DARK AGES. The period from the fall of Rome, in 476, to the revival of learning, in the twelfth century, was characterized by a general stagnation of culture and learning. To this period, covering the greater part of the Middle Ages, the name Dark Ages has been applied. See MIDDLE AGES.

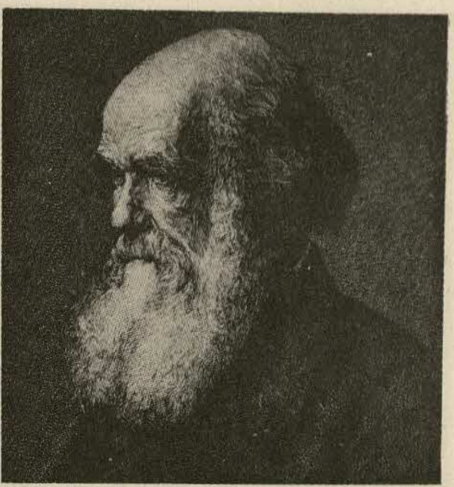
DARNING NEEDLE. See DRAGON FLY.

DARTER, or SNAKEBIRD. In some tropical countries the darter bird can be found on a riverbank. From its perch in a tree it darts swiftly toward the water, and with its long, sharp bill stabs fish with unerring aim. The long, snakelike neck gives this bird its second name. The darter is web-footed and is a good diver and swimmer. The bluish eggs are found in rudely constructed nests in trees near the eastern coast of tropical America, the western coast of tropical Africa, and in Australia. The bird is related to the cormorant.

DARWIN, CHARLES ROBERT (1809-1882). As the author of the theory of organic evolution, Charles Darwin startled the scientific world in the nineteenth century. His theory was the result of patient and painstaking efforts, and it caused practically a revolution in biological science.

Darwin was born at Shrewsbury, England. On his father's side he was the grandson of Erasmus Darwin, a well-known physician and poet; his mother was a daughter of another noted Englishman, Josiah Wedgwood, maker of fine pottery. His father, a successful physician, hoped that the son would become either a physician or a clergyman. Charles studied medicine for a time at Edinburgh University and attended Cambridge University to prepare for the ministry. However, his friendship with the botanist, Professor Henslow, convinced him that his real interest was in natural history.

Soon after Darwin received his degree from Cambridge, in 1831, Professor Henslow helped him to secure an appointment as naturalist with a government surveying expedition. The voyage, in the steamship *Beagle,* took the investigators all over the world. The survey lasted for five years, and during this time Darwin collected the vast store of material upon which his theories were based.



A SCIENTIFIC REVOLUTIONARY
Darwin expounded the theory of evolution.

The significance of Darwin's celebrated first book, the *Origin of Species,* was not that it presented a completely new theory. By the time it was published, in 1859, biologists had already noted similarities among certain plants and among certain animals, seeming to indicate that related species developed from a common ancestor. What Darwin had learned enabled him to organize and explain what other scientists had already noted.

The *Origin of Species* was enthusiastically welcomed by most scientists because it was the first detailed explanation of the theory of evolution. It attempted to show development of species of plants and animals through the process of *natural selection,* resulting in the *survival of the fittest.* While Darwin's theory of the causes of evolution is not accepted by all biologists, the basic idea of evolution is a part of modern science.

A number of other books were published by Darwin, including his *Descent of Man.* In this book he set forth his belief that man is also a part of the evolutionary process. See EVOLUTION.

NATURE PROVIDES DELICIOUS "CANDY"

Dates are rich in natural fruit sugars and, besides being good to eat, rank among the best of health foods. Most dates are still grown in their native land of Arabia, but fruit growers in California and Arizona are successful with dates which are harvested by girls (above). The peculiar, stunted date palm will not reproduce itself unless artificially pollinated.

DATE. Delicious, health-giving dates are the fruits of a palm that ranks second only to the coconut in usefulness. Date palms have furnished man with food for fifty centuries. Native to oases in the blazing, sandy wastes of Persia, Arabia, and North Africa, dates have been the mainstay of the nomads of these regions, for without this fruit there would be little food for the desert traveler.

The cultivated date palm requires hand pollination of the pistillate flowers, but it more than repays the care given it, after it is grown. With its roots implanted in the water of oases or irrigated groves, and its crown of branches, fifty to sixty feet high, thriving in the hot sun, this hardy palm, yielding food and welcome shade, lives far longer than man. A date palm is in its prime when it is 100 years old and often produces fruit for 200 years. The wood of the tree is utilized as lumber, the leaves are valued for thatch and matting, and the fiber is used for rope.

Dates first were grown commercially in the United States about 1890, with the importation of superior varieties from Egypt and Algeria, when the Salt River Valley of Arizona was settled. They had been introduced into arid sections of Mexico and Central America by early settlers, but the first attempts to grow them north of the Rio Grande met with failure. The type of date chiefly grown in America is called *Deglet Noor,* which means *date of light;* this is a choice variety imported from Algeria.

Although the date groves of the Imperial and Coachella valleys of California and the Salt River Valley of Arizona are profitable, they require considerable capital as an original investment, and need much care. Suckers from the crowns of young trees must be planted in rows, in sandy loam, and there must be a constant supply of underground water or irrigation to nourish the trees. It takes several years before the first cluster of fleshy, hard-seeded fruit appears. A full-bearing tree bears from 100 to 200 pounds of fruit, in bunches of twenty-five pounds. Since the dates on a tree do not all ripen at the same time,

AN EXPRESSION OF PATRIOTIC AMERICAN WOMANHOOD
The beautiful Continental Memorial Hall at Washington, D. C., is the headquarters of the Daughters of the American Revolution, most active of women's patriotic organizations.

they must be hand-picked. After picking, the dates are carefully packed and prepared for shipment.

Today, production in the United States averages about 10,000 pounds to the acre, and efforts are constantly being made to increase this yield. The fruit, eaten fresh or dried, is a nutritious food, containing sugar, iron, lime, and health-promoting vitamins.

DAUDET, *do dá',* ALPHONSE (1840-1897). An outstanding French writer of the nineteenth century, Daudet had the ability to set forth clearly what he saw. He is best known as a storyteller, although he also wrote poetry and plays. Born at Nîmes, France, he spent a rather uneventful childhood, attending the college at Alais after the death of his father. For a while he tutored, but finally went to Paris to join his brother.

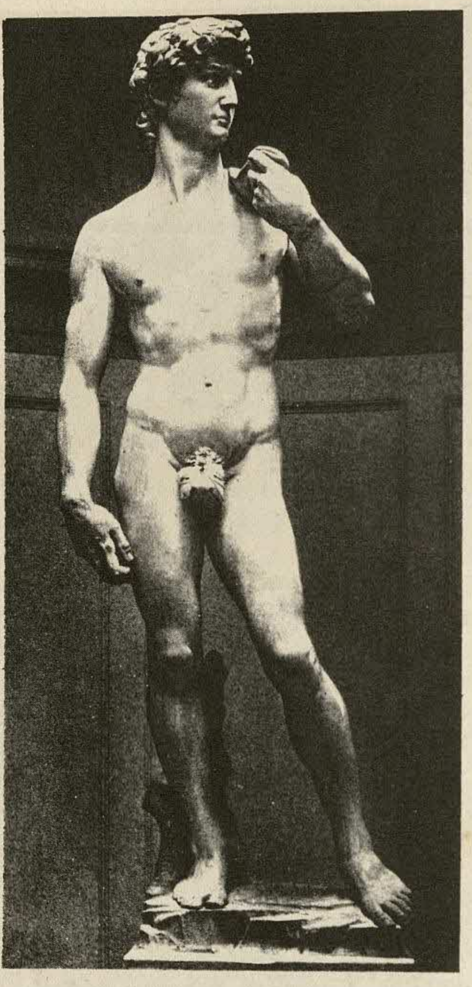
His first book of poetry, *Les Amoureuses,* published when he was eighteen years old, made little impression. But his volumes of stories, *Letters From My Mill* and *Monday Tales,* gained him recognition which paved the way for the novels *Numa Roumestan, The Nabob,* and, what he considered his greatest, *Sapho.* The latter has been widely dramatized.

DAUGHTERS OF THE AMERICAN REVOLUTION. A patriotic society of women whose ancestors fought on the American side in the American Revolution was organized at Washington, D. C., in 1890. The society is known as the Daughters of the American Revolution. Its purposes are to preserve records of individual achievement in the war, to promote the American ideal of liberty and freedom, to collect relics, and to erect monuments to mark scenes of historical interest. In 1896 it was incorporated by act of Congress.

The organization maintains Memorial Continental Hall in Washington, where its annual conventions are held. It also deposits historical relics in the National Museum. The work is carried on by 2,500 local chapters in the United States, Canada, Alaska, and Hawaii. The combined membership is about 150,000.

DAUGHTERS OF THE CONFEDERACY, UNITED. See CONFEDERACY, UNITED DAUGHTERS OF THE.

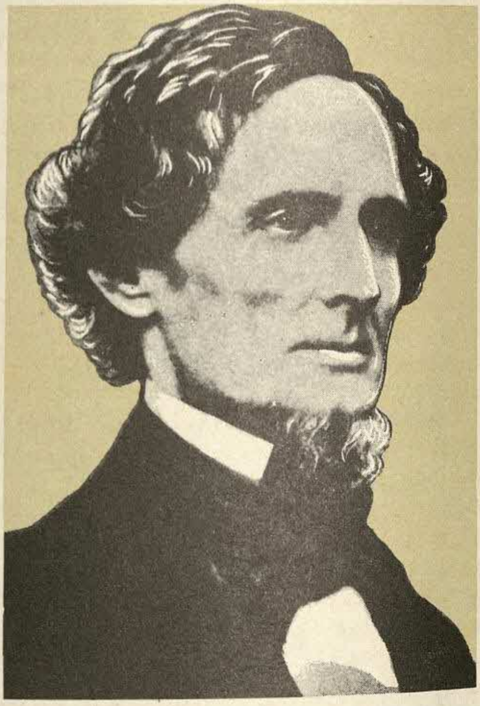
DAUPHIN, *daw' fin.* This French word for the queer-looking sea animal, the dolphin, was adopted in 1349 as the title for the heir to the throne of France. It was first used by the lords of the province



ISRAEL'S GREATEST KING
David, the poet king, whose Psalms belong to the world's greatest literature. According to the Bible story, the boy David slew the giant Goliath with his slingshot.

of Vienne, whose family crest consisted of three dolphins (dauphins). Humbert II, the last of these lords, was without an heir, and so he willed his possessions to the grandson of Philip VI of France, with the provision that the heir apparent to the throne of France should always bear the title, Dauphin of Vienne, and govern the province. Gradually the province was absorbed into the kingdom, and the name became simply a title which was used until the Revolution of 1830.

DA'VID, (1041-970 B. C.). The story of this great king of Israel is told in the Bible in the two books of *Samuel,* the first book of *Kings,* and in *Chronicles I.* A shepherd boy, he was the youngest son of Jesse, a resident of Bethlehem. David was especially chosen by the Lord to succeed Saul, Israel's first king. He first ruled over Judah alone, being forced to fight the armies of Saul for seven years before he was acknowledged king of all Israel. David reigned from the capital city of Jerusalem, and the kingdom reached the height of its power during his life. He was the author of the *Psalms.* For other information see BIBLE STORIES.



Jefferson Davis, the soldier statesman who became the first and only President of the Confederate States during the Civil War.

DAVIS, JEFFERSON (1808-1889). Time honors the memory of men who dedicate their lives to a cause and struggle against ever-increasing odds in the interest of what they believe is right. Jefferson Davis, American soldier and statesman, was one of these men. As President of the Confederate States of America, he gave an example of devotion that is warmly cherished by the South today. Along with Calhoun and Haynes, Davis is remembered, too, as a staunch defender of the principle of states' rights.

Jefferson Davis was born on June 3, 1808, in Christian (now Todd) County, Kentucky. The family later moved to Mississippi, where the boy had his first schooling. He entered West Point at the age of sixteen. Although not outstanding as a student in the Academy, the young Southerner showed strength of character and military ability. After graduating, he spent seven years fighting Indians on the northwestern frontier.

While engaged in these wars, Davis adminstered the oath of enlistment to the man whom he was later to oppose, both with politics and the sword—Abraham Lincoln. Retiring from service, he married the daughter of General Zachary Taylor and took up cotton planting in Mississippi. Within a few months, however, his wife died.

With an election to Congress in 1845, Davis's career as a statesman began. But the outbreak of the Mexican War forced him to return to military duty with the rank of colonel. Wounded during the Battle of Buena Vista, he was crippled for some time after the war.

Again entering Congress in 1847, this time as a Senator, he succeeded Calhoun as leader of the Southern party. However, for a period this position was forsaken for the post of Secretary of War under President Pierce.

Returning to the Senate, he argued for states' rights on the question of slavery until Mississippi seceded in 1861. Davis's farewell address held the interest of both political friends and enemies.

At first elected head of the provisional Confederate government, he was later elected President of the Confederate States, with headquarters at Richmond, Va. As a soldier and organizer, President Davis probably ranked below his General, Robert E. Lee; the great service rendered by him during the war lies in the stability and balance he provided in the state of emotional turmoil. After the fall of the Confederacy, Davis was kept prisoner in Fortress Monroe until freed through the efforts of Northern admirers.

In his last days he lived in Memphis and Mississippi, writing *The Rise and Fall of the Confederate Government,* his view of the struggle. He is buried in Richmond, where a monument to his memory now stands.

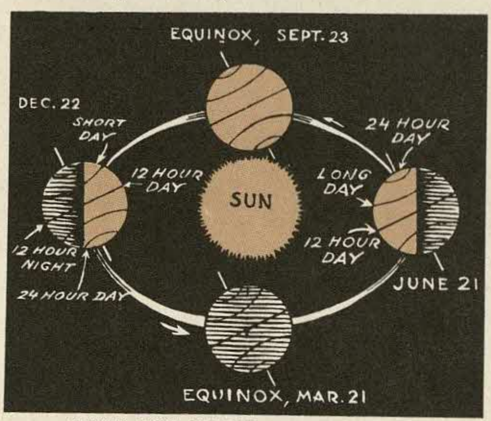
SCIENTIFIC LIFESAVER

It was Sir Humphrey Davy who, in 1815, invented the miners' safety lamp which prevents gas explosions in coal mines. He was also noted for his work in chemistry and electricity.

DAVIS STRAIT. Lying to the northeast of Canada, the Davis Strait is a long, narrow sea that separates North America and Greenland and connects Baffin Bay with the Atlantic Ocean. It is narrowest where it is crossed by the Arctic Circle, being about 200 miles wide at that place. The strait was discovered in 1585 by the explorer John Davis, after whom it is named.

DAVY, Humphry, Sir (1778-1829). Outstanding British chemist and inventor, Sir Humphry Davy made invaluable contributions to chemistry by his electrolytic experiments in the isolation and discovery of seven elements—sodium, potassium, calcium, strontium, barium, boron, and chlorine. He also discovered several hydrogen compounds and evolved a theory of electrochemistry which is still used today with few modifications. He was the inventor of the safety lamp, which has safeguarded the lives of thousands of miners from explosions caused by fire damp.

Davy's papers reporting his experiments and investigations with the galvanic battery earned for him, when he was twenty-four years old, the appointment as professor of chemistry at the Royal Institution at London. Although Davy made a special study of agricultural chemistry and tanning, delivering popular lectures on these subjects, his main interest was in electrochemistry. For his contributions to chemical science, he was made a baronet in 1818, and two years later was elected president of the Royal Society.



WHY WE HAVE SHORT AND LONG DAYS

The earth is tipped on its axis, so that sunlight strikes the temperate zones at angles which depend on the earth's position in its orbit.

DAY. For almost all of the long, long period that man has lived on the earth, he has known nothing about the motions of the earth and the sun. Primitive man knew only that the flaming ball of light seemed to rise on one side of the earth, climb high into the sky, and disappear at the opposite horizon. To the period in which the sun was visible our Saxon ancestors gave the name *day,* which meant *the time of heat.* But in time the word came also to have another meaning.

During daylight all of man's activity took place; at night he rested and slept. So in reckoning time he would say that such and such a thing happened so many days ago, and after a while began to think of a day as a period of time including one crossing of the sun and one night. That is how it came about that we can say that days are longer in summer than in winter, and, equally correctly, but using the word in a different sense, say that each day has twenty-four hours, usually divided into two equal series.

The reason why summer days are longer than winter days can easily be seen if we take an apple or an orange and call it the earth, and with it and a lamp imitate the earth's rotation around the sun. In this experiment we will call the stem end the North Pole. Holding the apple at the level of the lamp, but a few feet away from it, we will tilt it slightly toward one of the walls of the room. In this position the rays which come directly from the light will illuminate half of the apple. If the North Pole is in this half, we have but to carry the apple around to the other side of the lamp, keeping it tipped toward the same wall as before, and the North Pole will be in the dark half.

Suppose we mark a spot halfway between the North Pole and the widest part of the apple, and call it Chicago. If we hold the apple in the same position as before, in that part of the room in which the North Pole leans most toward the light, and then spin the apple slowly around its core, we shall see that it takes Chicago a longer time to pass through the light than through the darkness. On the opposite side of the lamp the reverse will be the case; it will be winter in Chicago, and the nights will be longer than the days. Halfway between the two positions, on either side of the light, day and night will be equal, as they are in spring and fall.

Varying Lengths of Days. Though there is usually a slight difference, days and nights at the equator are approximately equal in length. Throughout the Northern Hemisphere, the longest day occurs on or about June 21st; the shortest, on or about December 21st. In most of United States, the longest day will range between fourteen and sixteen hours, the shortest between eight and ten hours. At the Poles, there is almost constant daylight for six months, followed by six months of nearly continuous darkness.

DAY LILY. Opening at dawn, the large, white bell-shaped flowers of the day lily die with the setting sun. Day lilies are often seen in old-fashioned gardens, and may be recognized by their long leaves and the branched stems that bear the fragrant, short-lived blossoms. They are native to China and Japan.

DAY'TON, OHIO. The sixth largest city of the state, Dayton is located about fifty miles northeast of Cincinnati, in a fertile valley where the Mad and Stillwater rivers join the Great Miami. From the business center the land slopes upward from 100 to 400 feet, and on the higher levels are many of the city's finest residences. The city has a population of about 261,000.

Dayton is one of Ohio's ranking industrial cities. It is the world's largest center for the making of cash registers, and has thriving manufactures of computing scales, electric refrigerators, golf clubs, automobile accessories, airplanes, fare registers, and paper-cutting machinery. Several well-known magazines are printed in Dayton, as well as government stamped envelopes.

Eight miles east of the city is the huge government air base, Wright Field. This was named in honor of Orville and Wilbur Wright, who lived in Dayton. The air base is the leading aviation testing ground of the United States Army Air Service. Extensive experimental and aeronautical research laboratories and two large landing fields are provided for in its 5,000 acres.

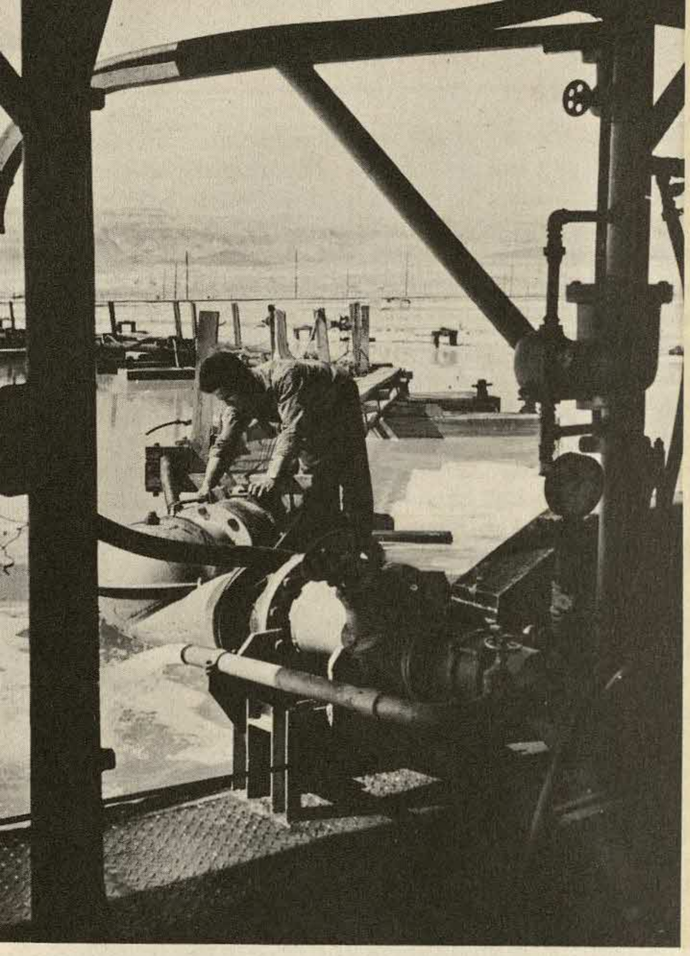
Dayton has many points of interest and beauty. On the slopes adjoining the city to the west stands the National Military Home, in the midst of its 640-acre park. In Van Cleave Park, along the main river, is the first house erected in Dayton, now the city's historical museum. Dayton is the home of the University of Dayton (Catholic) and two theological seminaries, Bonebrake and Central.

Jonathan Dayton, for whom the city was named, and two army officers first settled on the Great Miami River in 1796 on land purchased from the Indians. Incorporated in 1805, Dayton was chartered as a city in 1841. In 1913 the Great Miami River overflowed, cutting Dayton off from the outside world for many days. Flood control has now eliminated the danger of further flood disaster. The city has operated under the commission-manager form of government since 1914.

DDT. This powerful insecticide is a chemical compound with the impressive name *dichloro-diphenyl-trichloroethane.* Although it was first known in 1875, it did not come into prominence until it had proved its value during World War II in preventing the spread of such insect-borne diseases as typhus and malaria. Released for civilian use after the war, it is now finding increasing use in fighting insect pests. DDT is applied usually as a liquid spray or dusting powder and is seldom used in its pure state.

DEAD-LETTER OFFICE. Mail that cannot be delivered by local post offices is sent to the dead-letter office, a bureau of the Federal Post Office Department. If an unclaimed letter or package bears the sender's name and address it is returned to him; otherwise, after thirty days it is forwarded to the dead-letter office. Mail matter is undeliverable through two main causes—carelessness and ignorance. Addresses are often incorrectly written or are so illegible that the consignee cannot be determined; sometimes letters are mailed without address, or with wrong address.

More than 11,000,000 pieces of undeliverable mail have been handled by the dead-



Israel Office of Information

LIVELY DEAD SEA

Though there are no fish in the Dead Sea, there's plenty of industrial activity. Shown at left is one of several suction pumps at the potash works near Sodom, at the south end of the Dead Sea. A similar plant at Kallia, in the north, was destroyed by the Arabs in an invasion in 1948. Potash, bromine, salt, sulfur, gypsum, and phosphate form the basis of a thriving chemical industry, and account for an important part of Israel's exports. Today, Kallia has become one of Israel's most popular health resorts. Lowest point on the earth's surface, the Dead Sea is fed by the Jordan, Zerka, Arnon, and other streams, but has no outlet. It is walled in on the east and west sides by low mountains.

letter office of the United States in a single year. Each package or letter is opened; if its contents identifies the sender, it is returned to him; if unidentified, everything of no value is destroyed. Approximately $1,000,000 in undeliverable cash, drafts, and checks may be returned to senders in a year. If money cannot be returned, it is added to the revenues of the department. The head dead-letter office is at the main post office in Washington, D. C., and branches are maintained in several cities.

DEAD SEA. Few things in the world are named more appropriately than the Dead Sea, a historic salt lake forming part of the boundary between Israel and Jordan (formerly Transjordan). Nothing lives in its waters, and there is little or no life around its bleak shores of desert sands and barren limestone cliffs. In a geological sense, too, it is "dead," for the sea has no outlet, and only the river Jordan and a few other tributaries flow into it.

The Dead Sea, at a level of 1,290 feet below the surface of the Mediterranean Sea, in the lowest open space on earth, is about forty-seven miles long and some nine miles wide. Its water is not fit for drinking, for it has an unpleasant taste and odor. The sea contains enormous quantities of salt and other minerals. Its salt content, six times greater than that of the ocean, is so dense that a human body will not sink in its water. In 1952 the Jordan government took over the extracting of its salt, formerly done by a private company. Other minerals include magnesium compounds.

In the Bible and other religious writings, the Dead Sea is called the Salt Sea, Sea of the Plains, or East Sea. Near its shores were the cities of Sodom and Gomorrah.

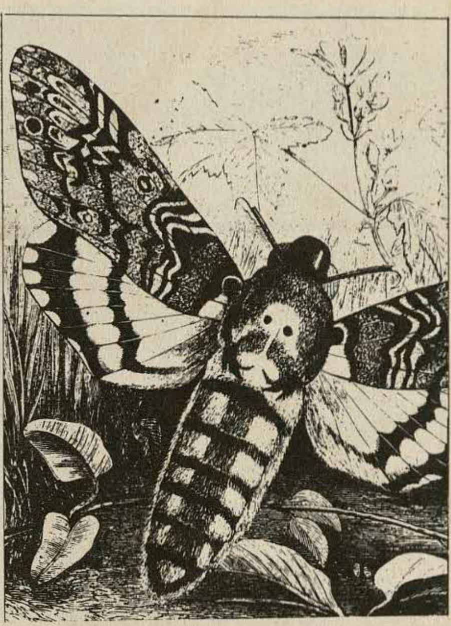
DEAF, *def,* **AND DUMB.** Whenever a person is unable to hear and speak, he is said to be both deaf and dumb. Most mutes are dumb only because, being unable to hear, they have never learned to imitate vocal sounds. A small percentage of deaf-mutes, however, are afflicted with defective speech organs.

Deafness may be either congenital (present at birth) or acquired (accidental). Congenital deafness may be caused by arrested development or by transmission of disease. Acquired deafness may occur at any age, from injury to the ear drum or through some disease which may cause pus formations in the inner ear, damaging its delicate parts.

About half the cases of deafness are acquired after the individual has lived a normal life for many years. Naturally, in such cases, the individual does not lose his speaking ability. Several electrical devices which transmit sound vibrations by air or bone conduction are available to those who are partially deaf. Such a device consists of an amplifier, a receiver, a small battery, and a tiny conducting instrument which is worn in the ear or inconspicuously behind it. Such an apparatus enables one who is partially deaf to hear almost perfectly, and makes communication with his fellow creatures possible for the extremely deaf person.

Education for deaf-mutes was introduced into Germany, England, and France in the latter part of the eighteenth century. The first school for the deaf in the United States was established in 1817 at Hartford, Conn., and students from many states entered. There are over 150 state, private, and public day schools for the deaf in the United States, and many Canadian cities maintain such institutions. Outstanding among these schools is Gallaudet College in Washington, D. C., the only institution devoted exclusively to higher learning for the deaf.

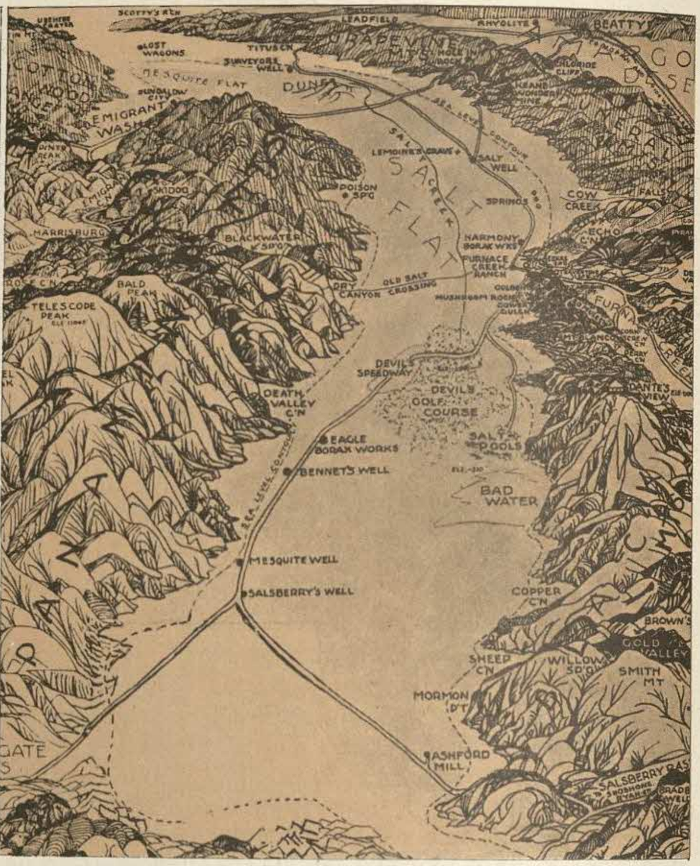
Where there is no serious impairment of the vocal organs, even the totally deaf can be taught to speak. A deaf-mute learns to make speech sounds by placing his hands on the teacher's throat, feeling the vibrations as words are spoken, and then imitating these vibrations. Deaf-mutes who do not use the spoken word communicate with one another by the sign language or by lip reading. Sign talking consists of forming words and letters by motions of the hands (see SIGN LANGUAGE). This method has been largely superseded by lip reading, which is now taught in all schools for the deaf and in evening classes maintained in connection with public schools. Helen Keller, who became blind and deaf in early childhood, has given the world an inspiring example of courage under disabling handicaps. See KELLER, HELEN ADAMS.



THE INSECT WITH A LEGEND

Because of the skull which appears on the back of a death's head moth, the insect has long been associated with mystery and magic. Actually, he is no more harmful than most moths; that is, in the caterpillar stage he destroys vegetables.

DEATH'S HEAD MOTH. Despite the strange marking of a human skull on the back of its thorax, the death's head moth is no more dangerous than any other insect of its kind. It is a large moth, its average size being five inches between its wing tips. It sometimes attacks bees and eats their honey.



SUN-BAKED RICHES
Death Valley, hottest and lowest spot in the United States (above), was long believed useless. Then hardy pioneers found borax, a valuable mineral, and the era of the twenty-mule teams began. They followed certain trails (left) to the mines. Recently, highways have been built over these trails, opening more mines.

DEATH VALLEY. Near the eastern boundary of California is a vast, desolate region known as Death Valley. Here, under the shadow of the Panamint Mountains, is the lowest spot in the United States, for the entire valley is below sea level, at one point being 276 feet beneath the ocean's surface.

Death Valley is about 150 miles long and from ten to thirty miles wide. It received its name in 1849, when a band of men bound for the California gold fields became lost in it, most of their number dying from thirst and hunger. The valley has some plant and animal life, in spite of its heat and arid conditions.

The region is administered by the Department of Interior as a national monument, and prospectors are licensed by that department. The valley has valuable deposits of borax.

DEBORAH, *deb'o rah.* A prophetess of ancient Israel, Deborah delivered her people from the Canaanites, who had oppressed them for twenty years. According to the *Book of Judges* in the Bible, she and Barak led an army of 10,000 men against Sisera, king of Canaan, defeating his army. The fifth chapter of *Judges,* a poem called the *Song of Deborah and Barak,* commemorates the victory of the Israelites.

DEBT.

Neither a borrower nor a lender be;
For loan oft loses both itself and friend,
And borrowing dulls the edge of husbandry.
—*Shakespeare's Hamlet*

The modern world does not follow the advice of Shakespeare's Polonius literally. Debts may be either good or bad, depending upon the use to which the money is put. To borrow money for the purchase of a luxury is folly, but borrowing to build a home or to conduct a business, if there are reasonable prospects for repaying the debt, is a wise move. Such a debt serves to make the borrower put forth honest effort.

In a broad sense, a debt may consist of money, goods, or services. In law, debt is regarded as a sum of money due under a special contract or specific agreement.

Debtors (those who owe money) formerly were imprisoned for their failure or unwillingness to pay. This practice was discontinued in the United States early in the nineteenth century, but several European nations punished debtors by sentences in jail until nearly a hundred years later. Today, no modern nation imprisons a person for failure to pay a debt unless fraud was intended.

To collect a debt today, a creditor brings a civil suit against the debtor. If the debt can be shown to be bona fide, a judgment ordering payment is issued against the debtor by the court. If settlement then is not made, enough of the debtor's property may be seized and sold to pay the debt and court costs. See CIVIL LAW; CONTRACT.

DEBT, NATIONAL. See NATIONAL DEBT.

DEBUSSY, *de bu se',* CLAUDE ACHILLE (1862-1918). Harmonies that have a delicate, imaginative quality far different from those of earlier composers mark the music of Claude Debussy, brilliant French composer. His words, considered to be the beginning of the so-called new French school, aroused interest because of their colorful arrangement for instruments.

Debussy early was recognized as an outstanding musician, receiving the Grand Prix de Rome and several other awards while a student at the Paris Conservatory. He won his first international notice with the production of the opera *Pelleas and Melisande.* After that he added to his reputation by writing several ballets, music dramas, songs, and instrumental works. His best-known composition is the symphonic poem, *The Afternoon of a Faun,* played by symphony orchestras everywhere.

DECALOGUE, *dek'a log.* Because the Jews called the Ten Commandments the *ten words,* the Greeks gave these historic laws the name *decalogue,* from their words for *ten* and *word.* Moses is said to have received the commandments on two stone tablets on Mount Sinai. Christians have changed the order of the Decalogue somewhat. Protestants list as the first commandment the law to worship no gods before God, and the prohibition of graven images as the second. Roman Catholics combine these two as the first commandment. Protestants, however, combine the commandments against coveting a neighbor's wife and coveting his property, as the tenth; Catholics divide them as the ninth and tenth commandments, respectively.

DECA'TUR, STEPHEN (1779-1820). American naval history would be incomplete without the mention of Stephen Decatur, a gallant naval commander in the War of 1812 and the man who defied the Barbary pirates of the Mediterranean. Decatur became a midshipman when he was nineteen years old. Four years later, he was a first lieutenant; and in 1804, at the age of twenty-five, he received his first command, the *Enterprise,* sailing the Mediterranean Sea.

At the time, these waters were infested with pirates from Tunis, Tripoli, and Algiers. Decatur, however, refused to accede to the pirates' requests for tribute and set about ending the outrages. Without the loss of a man, he destroyed the *Philadelphia,* an American vessel which had been captured by pirates and was being held in the harbor at Tripoli. For this achievement he was promoted to the rank of captain. His exploit led to a treaty with Tripoli, ending the payment of tribute.

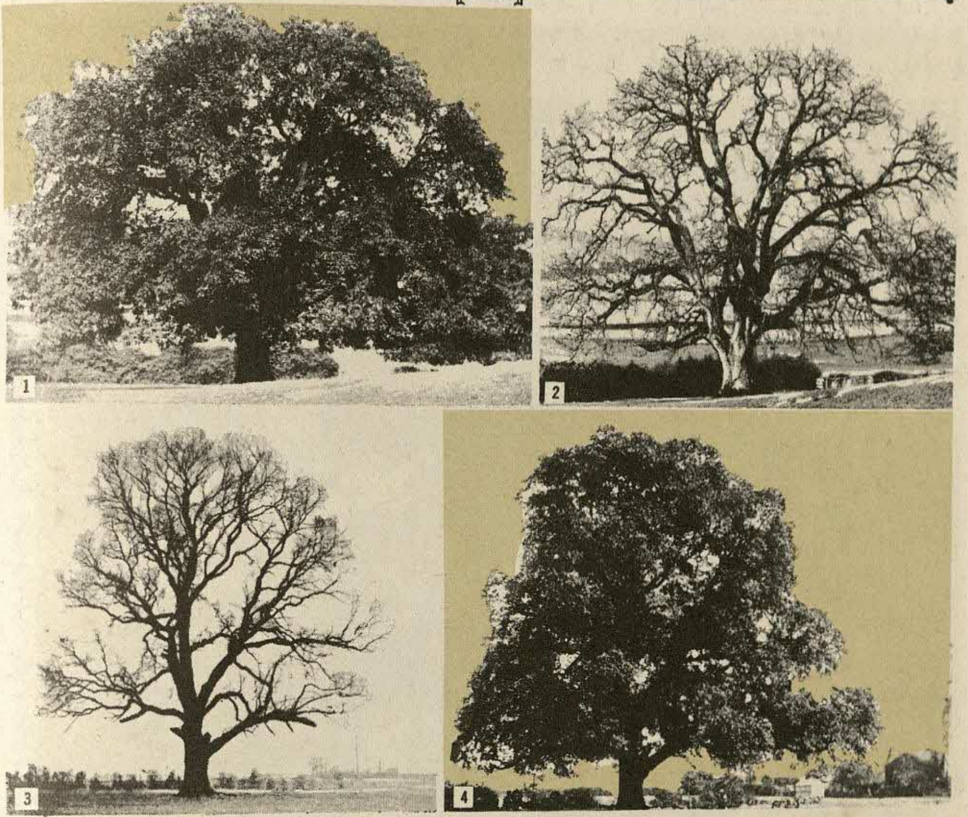
When the War of 1812 broke out, Decatur commanded a squadron of three vessels. He captured the British frigate *Macedonian* in a stirring sea battle off the Atlantic coast and brought his prize back to New York harbor. But a British blockade forced him into New London, Conn., harbor, where he had to remain for some time. Finally, in 1815, he decided on a bold venture. Commanding a swift vessel,

AMERICAN HEROISM DOWNS THE SAVAGE BARBARY PIRATES

Sent out to exterminate the pirates of Tripoli, who preyed upon all Mediterranean shipping, Stephen Decatur and his little navy did a thorough job of it. But on several occasions the pirates boarded the American vessels and fought the sailors hand to hand. A seaman, Reuben James, once threw himself beneath a pirate sword (above) to save Decatur's life.

the *President,* he tried to run the blockade of four British men-of-war. He was, however, forced to surrender after a fierce battle.

After the war was over, he commanded nine vessels which again sailed to the Mediterranean, where the Algerians were still continuing their piratical activities.



THE TREES THAT CHANGE THEIR DRESS EACH YEAR

One of nature's most beautiful miracles is the yearly rebirth of deciduous trees. Unlike the evergreens, these trees do not keep their foliage the year around, but lose it in winter. (1 and 2) A walnut in summer and in winter. (3 and 4) An elm with and without its leaves.

He captured their flagship and ended forever the payment of tribute by Americans to pirates.

Stephen Decatur died in 1820 from a wound inflicted in a duel with James Barron, who had been court-martialed for surrendering to the British. Decatur was a member of the board, and Barron accused him of preventing his reinstatement.

DECEM'BER. Although December has always been the last month of the year, it has not always been the twelfth. In the earliest Roman calendar, December was the tenth month and got its name from the Latin word *decem*, meaning *ten*. Later two new months were added, and December was moved into twelfth place.

December, one of the long months with thirty-one days, ranks as one of the most popular months of the year. Two special occasions are Christmas and New Year's Eve. December 21st is the shortest day of the year; it is then that the winter sun is directly over the Tropic of Capricorn. See Calendar; Solstice.

DECIDUOUS, *de sid' u us,* **TREES.** Trees which lose their leaves in the fall and renew them in the spring are *deciduous* trees. The word comes from a Latin word meaning *to fall down* and refers to the falling of the leaves. Trees which are not deciduous are known as *evergreens*.

Most coniferous trees are evergreen; a few, however, like the larch, or tamarack, and the cypress, are deciduous. Oak and cherry trees, in mild climates, may be either deciduous or evergreen. See Evergreen; Coniferae; Tree.

IN CONGRESS, JULY 4, 1776

Liberty builds a New NATION

DECLARA'TION OF INDEPEND'-ENCE. In man's march toward liberty and freedom, his progress has been marked by events and documents that serve as beacons. One such guiding light is the Declaration of Independence, adopted by the Continental Congress of the American colonies on July 4, 1776, in Philadelphia. When it was signed, it had only the purpose of proclaiming the freedom of the American people. But today it has come to mean far more than that. It has changed the entire course of political thought. In the eighteenth century the world was ruled by kings—some of whom believed that they had been placed on their thrones by God to rule over other men. Poor men were not thought to be equals of those who had power and money; few people had any idea of what "the rights of man" were.

The Declaration of Independence, however, threw a new light on man's status in the world. It said that "all men are created equal" and that "governments derive their just powers from the consent of the governed." This view has not been accepted by some countries even today, but these words, written by Thomas Jefferson, who drafted the immortal document, have remained a symbol of democracy and freedom.

How It Came to Be. Even though relations between the colonies and England had been strained for years before 1776, there was little desire for independence. Most of the inhabitants of the colonies were Englishmen who wished to remain so. But, from the day in April, 1775, when a group of New England farmers protected a bridge at Concord, Mass., from the British, until July 4, 1776, the movement for independence gained strength. It was forced through circumstances. Even when the Declaration was approved, it was estimated that not more than a third of the colonists really wanted to be free of England.

The armed conflict was the principal element that forced the move to declare independence. The Continental Congress was waging a war; it had organized a fleet, issued money, and made loans. It was acting in the manner of an independent legislature, but its members frowned on independence. Then, in January, 1776, the English Parliament passed an act prohibiting other nations from trading with the colonies. This act infuriated the leaders of the revolt. High-handed tactics by the governors of the colonies added to their rage.

At the same time, a booklet entitled *Common Sense,* written by a revolutionary named Thomas Paine, was distributed throughout the colonies. It advocated independence and fanned the desire for freedom into a white heat. The conservatives began to lose control of the governments in the colonies, and revolutionaries who believed in independence came into power. Pennsylvania was an example; its assembly drafted a new constitution and instructed its delegates to the Continental Congress to seek colonial freedom. In May, 1776, the Continental Congress recommended that all the colonies form new governments, and on June 7 Richard Henry Lee of Virginia introduced a resolution recommending a declaration of independence and the formation of a confederacy of states. It is interesting to note that South Carolina, which later was to lead the South in secession from the Union, was then one of the conservative colonies, and was not in favor of independence.

The Continental Congress appointed a committee to draft a declaration. Jefferson wrote the document, and Benjamin Franklin and John Adams made minor changes. An informal vote on July 1 showed that New York and Pennsylvania were opposed to independence, Delaware was divided, and South Carolina wanted a delay. The vote on July 2 listed only New York as opposed, and the final draft was made. The Declaration was signed on July 4 by delegates of all the colonies except New York, and was made known to the world on that day.

The news spread like wildfire; and even though the feeling for independence was not unanimous, there was great rejoicing among the people. A new nation had been formed! New York finally agreed on July 9, and the engrossed copy of the Declaration was made. It now rests in the Library of Congress at Washington, D. C.

What It Did. The immediate effects of the Declaration were not very apparent during the war. However, after the Declaration the people knew what they were fighting for, and the war became a clear-cut issue, a decided aid to the struggling forces. Its major effects were the laying of a foundation for a great and prosperous nation, and its signing on July 4 has always been regarded as the birthday of the United States.

What It Says. Except for the principles of freedom and democracy, the Declaration is made up of indictments against the king of England. It reads as follows:

THE UNANIMOUS DECLARATION OF THE THIRTEEN UNITED STATES OF AMERICA

When, in the course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume, among the Powers of the earth, the separate and equal station to which the laws of nature and of nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

AN IDEAL GOES INTO ACTION

Inspired by the new concept of liberty, the American people arose against the misguided British king. The Declaration of Independence, immortal political document signed in stately Independence Hall (above), was their guiding star.

We hold these truths to be self-evident: that all men are created equal, that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness. That to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed; that whenever any form of government becomes destructive of these ends, it is the right of the people to alter or to abolish it, and to institute a new government, laying its foundation on such principles, and organizing its powers in such form, as to them shall seem most likely to effect their safety and happiness. Prudence, indeed, will dictate that governments long established should not be changed for light and transient causes; and accordingly all experience hath shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same object, evinces a design to reduce them under absolute despotism, it is their right, it is their duty, to throw off such government, and to provide new guards for their future security.—Such has been the patient sufferance of these colonies; and such is now the necessity which constrains them to alter their former systems of government. The history of the present king of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute tyranny over these States. To prove this, let facts be submitted to a candid world.

He has refused his assent to laws the most wholesome and necessary for the public good.

He has forbidden his governors to pass laws of immediate and pressing importance, unless suspended in their operation till his assent should be obtained; and when so suspended, he has utterly neglected to attend to them.

He has refused to pass other laws for the accommodation of large districts of people, unless those people would relinquish the right of representation in the legislature, a right inestimable to them and formidable to tyrants only.

He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved representative houses repeatedly, for opposing, with manly firmness, his invasions on the rights of the people.

He has refused, for a long time after such dissolutions, to cause others to be elected; whereby the legislative powers, incapable of annihilation, have returned to the people at large for their exercise; the State remaining, in the meantime, exposed to all the dangers of invasion from without, and convulsions within.

He has endeavored to prevent the population of these States; for that purpose obstructing the laws for naturalization of foreigners; refusing to pass others to encourage their migration hither, and raising the conditions of new appropriations of lands.

He has obstructed the administration of justice, by refusing his assent to laws for establishing judiciary powers.

He has made judges dependent on his will alone for the tenure of their offices, and the amount and payment of their salaries.

He has elected a multitude of new offices, and sent hither swarms of officers to harass our people and eat out their substance.

He has kept among us, in times of peace, standing armies without the consent of our legislatures.

He has affected to render the military independent of and superior to the civil power.

He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his assent to their acts of pretended legislation:

For quartering large bodies of armed troops among us:

For protecting them, by a mock trial, from punishment for any murders which they should commit on the inhabitants of these States:

For cutting off our trade with all parts of the world:

For imposing taxes without our consent:

For depriving us, in many cases, of the benefits of trial by jury:

For transporting us beyond seas to be tried for pretended offenses:

For abolishing the free system of English laws in a neighboring province, establishing therein an arbitrary government, and enlarging its boundaries, so as to render at once an example and fit instrument for introducing the same absolute rule into these colonies:

For taking away our charters, abolishing our most valuable laws, and altering fundamentally the forms of our government:

For suspending our own legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.

He has abdicated government here, by declaring us out of his protection, and waging war against us.

He has plundered our seas, ravaged our coasts, burnt our towns, and destroyed the lives of our people.

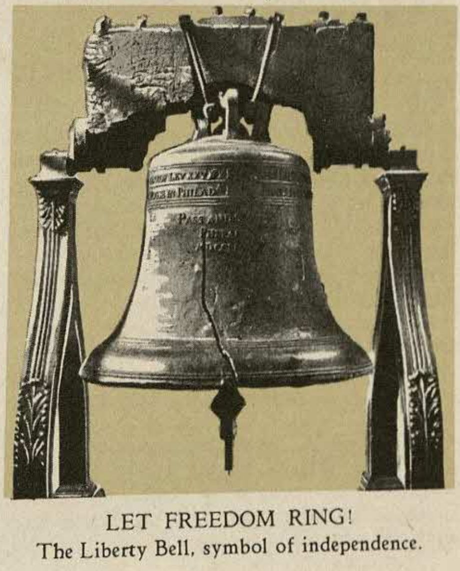
He is, at this time, transporting large armies of foreign mercenaries to complete the works of death, desolation and tyranny, already begun, with circumstances of cruelty and perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the head of a civilized nation.

He has constrained our fellow-citizens, taken captive on the high seas, to bear arms against their country, to become the executioners of their friends and brethren, or to fall themselves by their hands.

He has excited domestic insurrections amongst us, and has endeavored to bring on the inhabitants of our frontiers, the merciless Indian savages, whose known rule of warfare is an undistinguished destruction of all ages, sexes, and conditions.

In every stage of these oppressions we have petitioned for redress in the most humble terms: our repeated petitions have been answered only by repeated injuries. A prince, whose character is thus marked by every act which may define a tyrant, is unfit to be the ruler of a free people.

Nor have we been wanting in attention to our British brethren. We have warned them, from time to time, of attempts by their legislature to extend an unwarrantable jurisdiction over us.



LET FREEDOM RING!
The Liberty Bell, symbol of independence.

We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and consanguinity. We must, therefore, acquiesce in the necessity which denounces our separation, and holds them, as we hold the rest of mankind, enemies in war, in peace friends.

We, therefore, the Representatives of the United States of America, in general Congress assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the name, and by authority of the good people of these colonies, solemnly publish and declare, That these United Colonies are, and of right ought to be, free and independent States; that they are absolved from all allegiance to the British crown, and that all political connection between them and the State of Great Britain is, and ought to be, totally dissolved; and that, as free and independent States, they have full power to levy war, conclude peace, contract alliances, establish commerce, and to do all other acts and things which independent States may of right do. And for the support of this declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other our lives, our fortunes, and our sacred honor.

(Signed) John Hancock.

New Hampshire — Josiah Bartlett, Wm. Whipple, Mathew Thornton.

Massachusetts Bay — Saml. Adams, John Adams, Robt. Treat Paine, Elbridge Gerry.

Rhode Island—Step. Hopkins, William Ellery.

Connecticut—Roger Sherman, Sam'el Huntington, Wm. Williams, Oliver Wolcott.

New York—Wm. Floyd, Phil. Livingston, Frans. Lewis, Lewis Morris.

New Jersey—Richd. Stockton, Jno. Witherspoon, Fras. Hopkinson, John Hart, Abra. Clark.

Pennnsylvania—Robt. Morris, Benjamin Rush, Benja. Franklin, John Morton, Geo. Clymer, Jas. Smith, Geo. Taylor, James Wilson, Geo. Ross.

Delaware—Cæsar Rodney, Geo. Read, Tho. M'Kean.

Maryland—Samuel Chase, Wm. Paca, Thos. Stone, Charles Carroll of Carrollton.

Virginia—George Wythe, Richard Henry Lee, Th. Jefferson, Benja. Harrison, Thos. Nelson, Jr., Francis Lightfoot Lee, Carter Braxton.

North Carolina—Wm. Hooper, Joseph Hewes, John Penn.

South Carolina—Edward Rutledge, Thos. Heyward, Junr., Thomas Lynch, Junr., Arthur Middleton.

Georgia—Button Gwinnett, Lyman Hall, Geo. Walton.

DECLINATION, *dek lin a' shun.* Just as the earth is marked off in meridians, parallels, and an equator, so, too, are the heavens marked with imaginary lines. Consequently, when an astronomer locates a heavenly body, he uses declination, the distance in a north and south direction that a star lies from the celestial equator. It is determined by drawing circles which pass through the poles and cross the equator at right angles.

Such circles are known as *circles of declination;* there are twenty-four of them dividing the equator into twenty-four equal parts, or arcs, of 15° each. These arcs are known as *hour circles* and correspond to meridians on the earth's surface. Declination is combined with right ascension in accurately locating any heavenly body.

Every compass has what is known as *magnetic declination.* This simply means the difference between true north and the direction in which the compass needle points. See COMPASS.

DECOMPOSITION, *de kom po zish'un.* Chemically, decomposition occurs when a compound is broken down into simpler compounds or elements. For instance, water consists of two parts of hydrogen to one part of oxygen. The separation of oxygen and hydrogen by electricity is a decomposing process called *electrolysis.* Decomposition of compounds may be brought about not only by electricity, but by heat, light, or chemical reagents as well.

In the case of animal and vegetable matter, decomposition, or decay, is caused by bacteria or ferments. See BACTERIA.

DECORA'TION DAY. See MEMORIAL DAY.

DEED. In order to sell or transfer property, usually real estate, a person makes out a deed which, like a contract, makes the exchange binding by law. Deeds provide an accurate statement of ownership, and either warn the new holder or protect him from claims that may appear against the property. They are necessary to determine who should be taxed for property and to show ownership in case the second person desires to resell at any future time.

There are two forms of common deeds, the *warranty* deed and the *quitclaim* deed. The warranty deed states that the present owner has no debts or obligations connected with his property, and that he will be responsible for any claims made upon it after the new owner takes the property.

The quitclaim deed is a blunt statement of what the owner intends to do—quit his claim to the property. This type of deed is used when the property is mortgaged or when the seller has only part interest and is selling his interest. This deed serves as a warning to a buyer to investigate the property ownership thoroughly.

A deed must be completely written before it is exchanged. As a legal matter, it must be between competent parties and must be made under the free will of both. A deed is usually registered in the county recorder's office in the county in which the property is located. See CONTRACT.

Acme

FAWN-Y STUFF

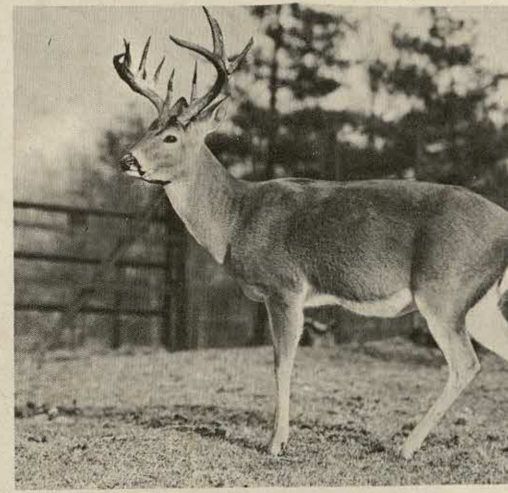
A little deer choses to share the milk from the bottle of a little dear.

DEER. Among the countless attractions of the woodland, none can surpass in grace and beauty the charm afforded by the presence of the splendid forest deer. The early settlers and explorers of America found deer practically everywhere in the timbered regions of what is now the United States and extending far into Canada and Mexico. Deer provided important items of the food and wearing apparel for the Indian tribes and for the white men who pushed westward the boundaries of civilized settlement.

HE HAS HIS POINTS

The Columbian black-tailed deer can afford to carry his head proudly. Not many people would be able to pass this buck without noticing the points of his spreading antlers.

New York Zoological Society



Although great numbers of deer are shot each year for food and sport, they have maintained themselves remarkably. With the proper observance by hunters of wise protective laws, these splendid animals should easily be preserved.

In the United States, several distinct kinds of deer are found in the great territory which they occupy. The better-known forms are the *Virginia* deer, found chiefly in the eastern part of the country; and the *mule* deer and *black-tailed* deer, which are the more common western forms. Other members of the deer family occur both in the Americas and in other parts of the world, such as the *red* deer or *stag,* the *fallow* deer, the *roebuck,* the *reindeer,* the *moose,* the *elk,* and the *wapiti.* Australia has no deer; and Africa has but few, antelopes taking their place.

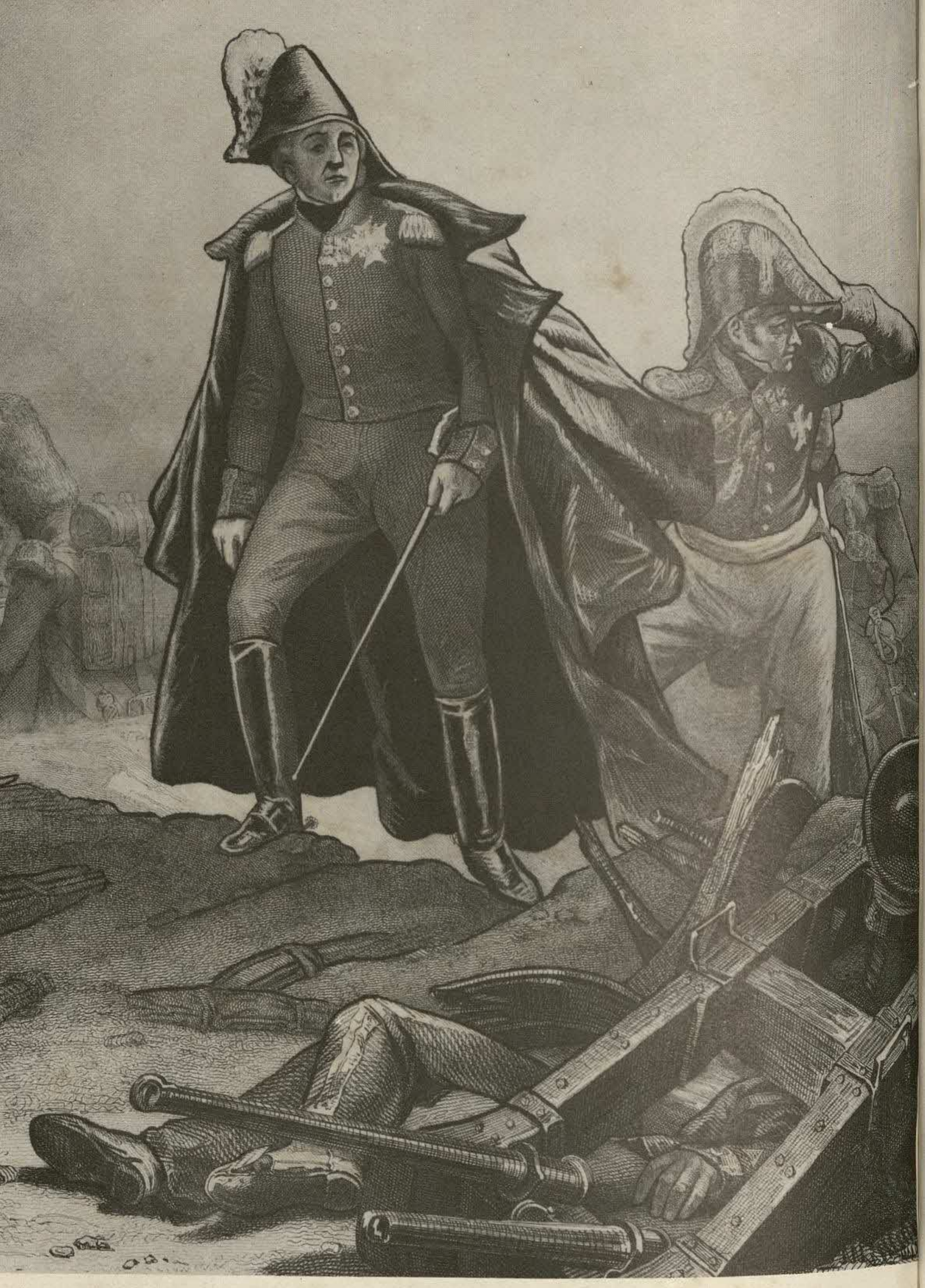
Alertness of manner, graceful bearing, and fleetness of foot are characteristic of

NOBLE BEAUTY

Combining dignity with unsurpassed grace, deer are common to most parts of the world. Their magnificent antlers grow to tremendous sizes, some having as many as twelve points. These are the weapons which are necessary in the bitter combats which take place every fall for leadership of the herd.

NORTH WHERE THE REINDEER RULES THE FARMYARD

In Lapland the average temperature is so low that the ordinary farm animals cannot survive. So the natives use hardy reindeer instead, for milk, for riding and driving, for food, and even for clothing. The Laplanders live in the northern regions of Europe.



ONE OF DELAROCHE'S HISTORICAL PAINTINGS

Louis Antoine de Bourbon, Duke of Angouleme and the last dauphin of France, is here shown at the Battle of Trocadero (1823), when the revolution in Spain was put down. The French deer. The male, or *buck*, deer, which sometimes weighs as much as 300 pounds, grows each year new horns known as *antlers*. When the horns are growing, during the spring and early summer, they are blunt at the ends and covered by a thick, soft skin known as the *velvet*. Later, this velvet dries and is rubbed off. The horns become smooth and sharp, ready to serve as effective weapons. During the winter they are shed, becoming detached close to the head. In the spring the female deer, or *doe*, gives birth to the young, which are usually beautifully marked with large white spots. The young are known as *fawns*. The color of deer varies considerably: it may be grayish, tawny, brown, or rusty.

The flesh of the deer, *venison*, is prized as a game food; the hide makes a valuable leather, *buckskin;* and dressed deer tendons make strong cords for outdoor equipment.

DEFOE′, Daniel (about 1660-1731). Few characters are better known to booklovers than is Robinson Crusoe, the hero of Daniel Defoe's great novel. But the ingenious Crusoe was only one of a great many people who live in the stories of Defoe, who was one of the first of the English novelists.

Defoe was born in London and was educated to be a minister. He went into business instead but got so heavily in debt that he turned to writing to pay it off. He infuriated so many people with his *Shortest Way With Dissenters* that he was pilloried and put in prison. He became a spy for the government to get out of prison. When Defoe was 60 years old, he published *Robinson Crusoe*, which was a huge success. Defoe's simple style of writing made his characters and situations seem very real. His *Moll Flanders* and *A Journal of the Plague* are well-known.

DE GAULLE, *duh gohl′*, Charles (1890-), military hero and President of France. He was born in Lille. He organized the Free French resistance in World War II. He headed the French government from 1944 to January, 1946, and became premier again in June, 1958. He secured the adoption of a new constitution providing for a strong executive, and became President of the Fifth French Republic in December of that year.

DE KALB, Johann, Baron (1721-1780). Bitter and hard as the American Revolutionary War was, it might have been even more difficult had it not been for liberty-loving European soldiers such as Baron Johann De Kalb.

Although he was a German, Baron De Kalb spent most of his life in the service of the French army. Previous to the American Revolution, he came to the colonies to study the strained relations between them and England. In 1777 he joined Lafayette in his journey to America. He gave the struggling colonial army great aid, particularly in the South, where he ranked second to General Gates. Baron De Kalb died in 1780 as a result of eleven wounds he received in the Battle of Camden, where he commanded the American forces.

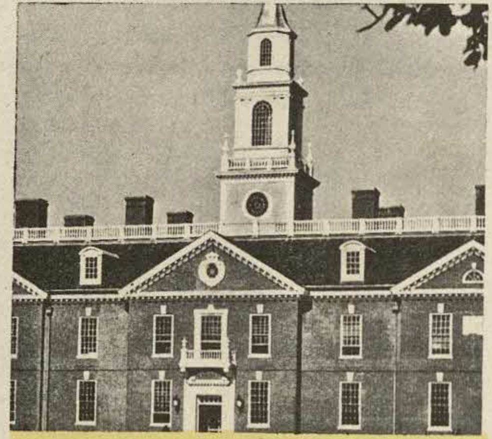
DELACROIX, *de lah krwah′*, Ferdinand Victor Eugène (1798-1863). By his skill in depicting historical scenes, Eugène Delacroix earned lasting fame as a painter. His departure from the classic forms aroused severe criticism, but the strength apparent in his work gained for his paintings the appreciation they merited.

He searched widely for subjects, his travels taking him as far as Africa and Palestine. Among the most celebrated of his paintings are *Algerian Women, The Entry of the Crusaders into Constantinople,* and *Jewish Wedding in Morocco,* which are in the Louvre. In the Metropolitan Museum in New York are *The Abduction of Rebecca* and *Christ on Lake Gennesaret.*

DELAROCHE, *de lah rohsh′*, Paul (1797-1856). Famed for his paintings depicting scenes from French and English history, Paul Delaroche is considered one of the outstanding French artists of the nineteenth century. In addition to his historical works, he was a portrait painter of note.

His paintings include *Death of Queen Elizabeth, Children of Edward IV in the*

Tower, Joan of Arc, and *Napoleon at Fontainebleau.* Although there is considerable beauty of design and color in his paintings, many experts consider that his work lacks feeling.

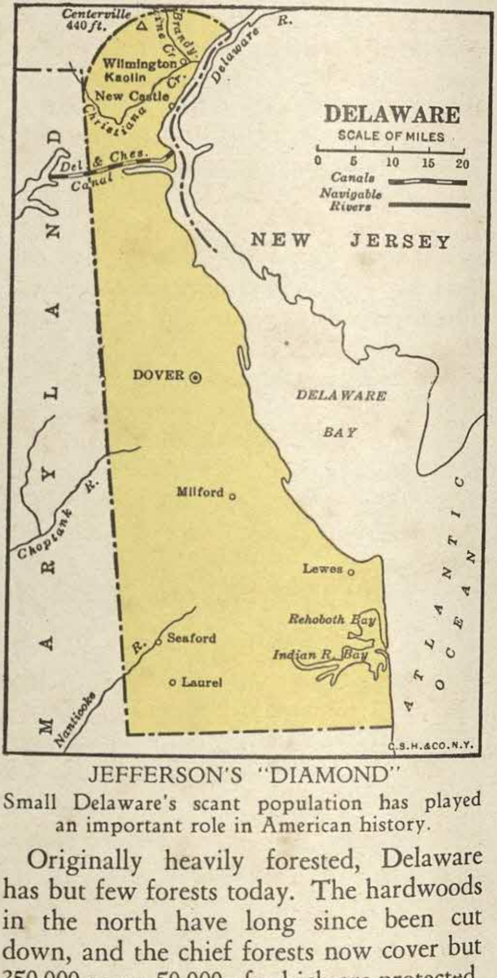


THE CHARM OF COLONIAL DIGNITY
The Delaware legislative building combines utility with the beauty of colonial architecture.

DEL'AWARE. Popularly known as the "Diamond State" and the "Blue Hen State," Delaware, one of the thirteen original colonies, has the distinction of having been the first to ratify the Constitution of the United States. One of the Middle Atlantic states, Delaware, has an area of 2,057 square miles, of which 79 square miles are water area. Only Rhode Island has a smaller total area. It is bounded on the south and west by Maryland; on the east by the Delaware River, Delaware Bay, and the Atlantic Ocean. On the north, the boundary is a great arc with New Castle as a center, so formed to settle a boundary dispute with Pennsylvania. The population is about 448,000.

Geography and Resources. With the exception of a few rolling hills in the north, Delaware is a flat state. The soil is sandy, and in the extreme south and along the central coast regions, there is much swampy land. Around Delaware Bay this swampland has been brought under cultivation by the erection of dikes to hold back the sea. The highest point in the state is but 440 feet above sea level.

Although there are numerous rivers in Delaware, they are too short to be of any great value for navigation. Those in the hilly northern areas are rapid and are a source of water power. Aside from the Delaware River and Delaware Bay, the only other waterway of importance is the Chesapeake and Delaware Canal, which extends across Northern Delaware and joins Chesapeake Bay with the Delaware River.



JEFFERSON'S "DIAMOND"
Small Delaware's scant population has played an important role in American history.

Originally heavily forested, Delaware has but few forests today. The hardwoods in the north have long since been cut down, and the chief forests now cover but 350,000 acres, 50,000 of which are protected.

Delaware has but few minerals, and these consist of gravel, sand, and clay beds and stone quarries.

The climate is mild, with a mean average temperature of 55°. Winters are short, for frosts seldom arrive before the middle of October. The annual rainfall is about forty-five inches.

Agriculture and Industries. Few states devote a larger percentage of their areas to agriculture than does Delaware. About eighty-five per cent of the land is devoted to agriculture, in spite of the fact that Delaware lies in the great eastern industrial region. Fruit orchards and truck farming lead in this field. Delaware ranks high in the production of fruits, peas, beans, and cereals. Most of the produce is raised for marketing in the near-by cities. Few field crops are raised, but corn and wheat are the leaders.

The industrial life of the state centers about Wilmington. There are located tanneries, shipbuilding yards, foundries, machine shops, cotton and fiber mills, and passenger-car factories. Near by are the famous Du Pont plants, where chemicals, lacquers, dyes, explosives, and leather substitutes are made.

The fisheries of the state are important and produce oysters, shad, menhaden, sea trout, and perch. From the menhaden both oil and fertilizer are obtained.

Transportation. Although inland water transportation is not of great importance, Delaware has fine harbors at Wilmington, New Castle, and Lewes. Splendid railway service is maintained throughout the state. A network of more than 1,800 miles of fine highways is maintained by the state.

Government. Although Delaware has but three counties, its state government is comparable to those of the largest states. The capital of the state is Dover. The governor is elected for a four-year term and may be re-elected once. The legislature consists of a senate of seventeen members elected for four-year terms; and a house of representatives of thirty-five members elected for two-year terms. The supreme court is composed of six judges appointed by the governor and confirmed by the senate. The judges hold office for a term of twelve years.

Education and Institutions. The state provides separate schools for white and colored pupils and furnishes all textbooks. The leading educational institution is the University of Delaware at Newark. There is a State College for Colored Students at Dover. Saint Andrew's School for Boys is near Middleton.

Under the direction of the Associated Charities of Wilmington many charitable institutions are operated. The state also has a Health and Welfare Commission which

THE DOVER STATE HOUSE TYPIFIES THE COLONIAL SPIRIT
High columned porches, commanding white towers, and sweeping vistas characterize the Capitol of Delaware, an outstanding example of Early American architecture.

has full charge of the work in the prevention and cure of tuberculosis.

History. Delaware was explored in 1609 by Henry Hudson and in 1611 by Lord de la Warr of England, for whom the state was named. No settlement was made, however, until 1631, when the Dutch founded a trading post near Lewes. Shortly afterward, the whole village was wiped out by the Indians. The first permanent settlement was made on the present site of Wilmington by the Swedes under Peter Minuit, in 1638. The Dutch, having previously claimed this region, drove them out in 1655 and were in turn driven out by the English in 1664. Delaware was governed by the Duke of York until 1682. Following this, the land was ceded to Penn, and was under the control of Pennsylvania until 1776, although in 1703 it was granted its own assembly. It became a separate state after the Declaration of Independence.

During the Revolution, Delaware furnished a regiment popularly known as the "Blue Hen's Chickens," whence arose the nickname "Blue Hen State." Delaware objected vigorously to the War of 1812, but, once the struggle began, gave it loyal support. At the time of the Civil War, Delaware was a slave state but remained with the Union. Some of its citizens, however, aided the South.

Consult the following titles for additional information:

Chesapeake Bay
Delaware Bay
Delaware River
Dover

DELAWARE. Calling themselves Leni-Lenape, meaning *real men,* the Delaware tribe of American Indians was one of the most important in the great Algonquian nation. They lived originally in Eastern Pennsylvania, Southeastern New York, New Jersey, and Delaware.

Under pressure of both whites and Iroquois, they were forced westward about the middle of the eighteenth century. They went into Western Pennsylvania and Ohio, where they joined the Hurons and fought against the white men. Later they moved on farther west into Missouri and Arkansas. Now they are scattered among various tribes in the Oklahoma Indian reservations. It was with the Delaware that Penn made his famous treaty.

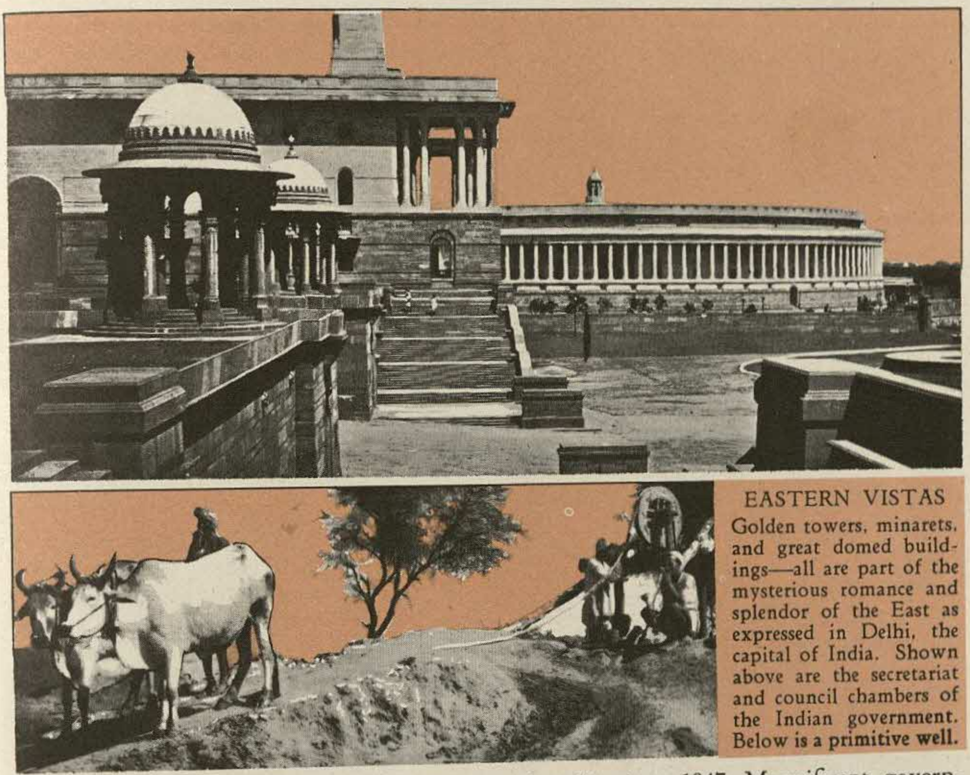
DELAWARE BAY. One of the most important shelters for sea-going vessels on the Atlantic coast is Delaware Bay, lying between Delaware and New Jersey. Near the entrance at Cape Henlopen, the United States government has built a large breakwater at a cost of $3,000,000. Into the waters of the bay flows the Delaware River. The bay is about forty miles long and twenty-five miles wide at the widest point. It has a channel varying from thirty to sixty feet deep.

DELAWARE RIVER. Rising in the Catskills of New York, the Delaware River follows a southerly course. It forms a natural boundary between New York and Pennsylvania, New Jersey and Pennsylvania, and New Jersey and Delaware, finally emptying into Delaware Bay. Although only 410 miles long, it is an important navigable river. Along its course are situated Philadelphia, Easton, Trenton, Camden, and Wilmington. Large vessels can ascend it as far as Philadelphia, smaller craft as far as Trenton. Its chief tributaries are the Lehigh and the Schuylkill.

DELAWARE WATER GAP. A beautiful, narrow canyon of the Delaware River is the Delaware Water Gap on the boundary between Pennsylvania and New Jersey. The river cuts through the Kittatinny Mountains for a distance of two to three miles. On either side steep, rugged mountains reach a height of more than 1,400 feet. The place has become popular as a summer resort.

DELHI, *del'e,* India. On the banks of the Jumna River, in Northern India, stands Delhi, the capital of British India since 1911. In this old city may be seen gardens, palaces, and mosques—reminders of a glorious past. In contrast are modern houses, hotels, railroads, flour and cotton mills, and sugar refineries.

Delhi was founded in the seventeenth century by the great Shah Jehan as head-



EASTERN VISTAS
Golden towers, minarets, and great domed buildings—all are part of the mysterious romance and splendor of the East as expressed in Delhi, the capital of India. Shown above are the secretariat and council chambers of the Indian government. Below is a primitive well.

quarters of the Mogul Empire. The Black Mosque, the Pearl Mosque, the Jumna Musjid (Great Mosque) of red sandstone and white marble, and the walled imperial palace (now used as soldiers' barracks), are monuments to this master builder of the Orient. It was Shah Jehan who built the world-famous Taj Mahal at Agra. The government college, the Residency, and a Protestant church are among the modern buildings.

The Silver Street, about one mile in length, is famous for its many bazaars and open-front shops, which sell to throngs of natives and tourists wares of silver work, woodcarving, brilliant fabrics, and other beautiful objects.

Queen Victoria was proclaimed Empress of India by Prime Minister Disraeli in Delhi. In 1912, the British and the Indians started construction of New Delhi about five miles to the southwest of Old Delhi. It became the capital of British India in 1931, and has been the capital of the state of India since 1947. Magnificent government buildings, temples, museums, and old historical relics are located in or near New Delhi. Old Delhi has a population of about 915,000 inhabitants, and New Delhi, 1,085,000.

DELI'LAH. *Weak* is the Hebrew equivalent for Delilah, the name of a woman whose story is told in the *Book of Judges*, in the Old Testament. She was a Philistine woman, beloved by Samson, the Jewish "Hercules." She betrayed him to his enemies, who, while he slumbered, cut off his long hair, believed to be the source of his great strength. See SAMSON.

DE'LOS. Ruins of ancient temples, fragments of magnificent statues, and specimens of pottery give evidence of the importance of the island of Delos to the ancient Greeks. Located off the coast of Greece in the Aegean Sea, it is the smallest of the Cyclades group, which includes Milo, or Melos, and Andros, among others. It is said that the god Apollo was born on

FORBIDDING CLIFFS ARE GUARDS OF DELPHIC MYSTERY

Sacred to the people of ancient Greece, the Oracle of Delphi was believed to be endowed with divine prophetic power. She lived near the Castalian Spring (above), which had remarkable cleansing power.

Delos, and in the days of Grecian glory, an oracle was located there. See Oracles.

DELPHI, *del'fi.* Most famous of the oracles of ancient Greece was that located at Delphi, principal shrine of the Olympian god, Apollo. Here, for 1,200 years, a priestess sat in the entrance to a cavern, counseled the men of the Grecian city states. The temple of the oracle was on the slope of Mount Parnassus, one of the residences of the gods. See Oracles.

DEL'TA. The area of land formed at the mouth of some rivers is known as a delta. The name comes from the fourth letter of the Greek alphabet, *delta,* which it resembles in shape.

When a stream meets a relatively quiet body of water, its current is checked, the silt it is carrying is dropped, and the sediment rolled along the bottom comes to rest. The resulting deposits will be gradually built up until they rise above low-water level. Ordinarily, the new land will have a roughly triangular shape, with its base slightly curved and its apex at the original mouth of the stream. One of the most famous deposits in history is that at the mouth of the Nile. The Greeks, through their trade with Egypt, very early became familiar with the delta of the Nile, and gave it that name.

Much of the material of deltas is very fertile, making delta land desirable for farm purposes, although sometimes it needs to be drained and sometimes to be irrigated. For this reason, and because of their trade advantages, some deltas, including those of the Nile and the Hwang Ho, have for centuries been the seats of very dense populations. Delta lands are constantly shifting, and the changing of a river course has in some cases caused disastrous floods, drowning thousands of people. Cities built on delta lands have many obstacles to overcome. The fine water-soaked delta soil makes it difficult to dispose of rainfall and sewage, to obtain a supply of pure water, and to make secure the foundations of high buildings.

The slowly advancing delta area of the Mississippi, the largest in the United States, contains about 12,000 square miles, of which several thousand acres are very productive. Larger deltas are those of the Brahmaputra, about 50,000 square miles in extent; and the Nile, about 20,000 square miles. Other notable deltas are those of the Ganges, the Po, and the Mackenzie rivers. See EROSION; RIVERS.

DELUGE, *del'uje.* Rain poured from the heavens for forty days and forty nights. It covered the earth with a blanket of water that drowned all the wicked people who had disobeyed the Lord's commands. And on this huge sea rode the Ark, containing Noah, a good man, his family, and two of every type of animal.

Such is the account of the great deluge in the Old Testament. According to the story, found in chapters six, seven, and eight of *Genesis,* the waters covered the earth for 150 days. At the end of that time the Ark came to rest on the top of Mount Ararat. See ARARAT, MOUNT.

DEMARCATION, *de mar ka'shun,* LINE OF. At the end of the fifteenth century, Spain and Portugal had a dispute over the ownership of the newly discovered Western World. They referred the matter to Pope Alexander VI for settlement, and he drew on the map the so-called Line of Demarcation, extending north and south and designated as 600 miles west of the Azores and Cape Verde Islands. To Spain he assigned all lands west of the line which that country had discovered, or might later find. To Portugal went all the land, acquired in a like manner, to the east of the line.

The division was later moved to 2,200 miles west of the Cape Verde Islands, cutting through South America. Because of the Line of Demarcation, Portuguese is the language of Brazil today, and Spanish is the language of the remainder of that continent. However, as easily can be seen if you run one finger eastward and another westward around the globe, eventually East meets West on the other side. Spain and Portugal found this fact to be true in the vicinity of the Molucca Islands and the Philippines, so a third line had to be drawn to settle their ownership.

DEMOC'RACY. See GOVERNMENT.

DEMOCRATIC PARTY. The oldest existing political party in the United States is the Democratic, which first became important with the election of Thomas Jefferson to the Presidency, in 1801. It numbers among its prominent leaders its founder, Jefferson, and such later Presidents as James Madison, Andrew Jackson, Grover Cleveland, Woodrow Wilson, and Franklin D. Roosevelt. It has been in power more years, in the century and a half since Washington took office, than any other party, and its history has been one of the most unusual of any American political group. See POLITICAL PARTIES IN THE UNITED STATES.

DEMOSTHENES, *de mos'the neez* (about 383-322 B. C.). Overcoming the weak lungs, defective speech, and awkward gestures of his youth, Demosthenes became the outstanding orator of the ancient world. Finding his power of speech as effective as money and the sword, he devoted his gift of oratory to the cause of independence, eventually ending his life rather than be taken by the conquering Macedonians. History records no greater Greek patriot or man of finer public or personal integrity.

Born of wealthy parents, Demosthenes found, at the age of seventeen, that his fortune had been dissipated by guardians. In

THE GREATEST ORATOR IN HISTORY FACES DEATH

Demosthenes was the finest political speaker and one of the greatest statesmen of ancient Athens. But his activity brought on the wrath of his enemies, and he finally took poison.

the court suit which followed, he defended his case and first learned the power of his own words. It is said that to overcome his physical handicaps, the young orator frequently went down to the seashore during stormy weather, filling his mouth with pebbles and trying to shout louder than the roar of waves breaking on the rocks.

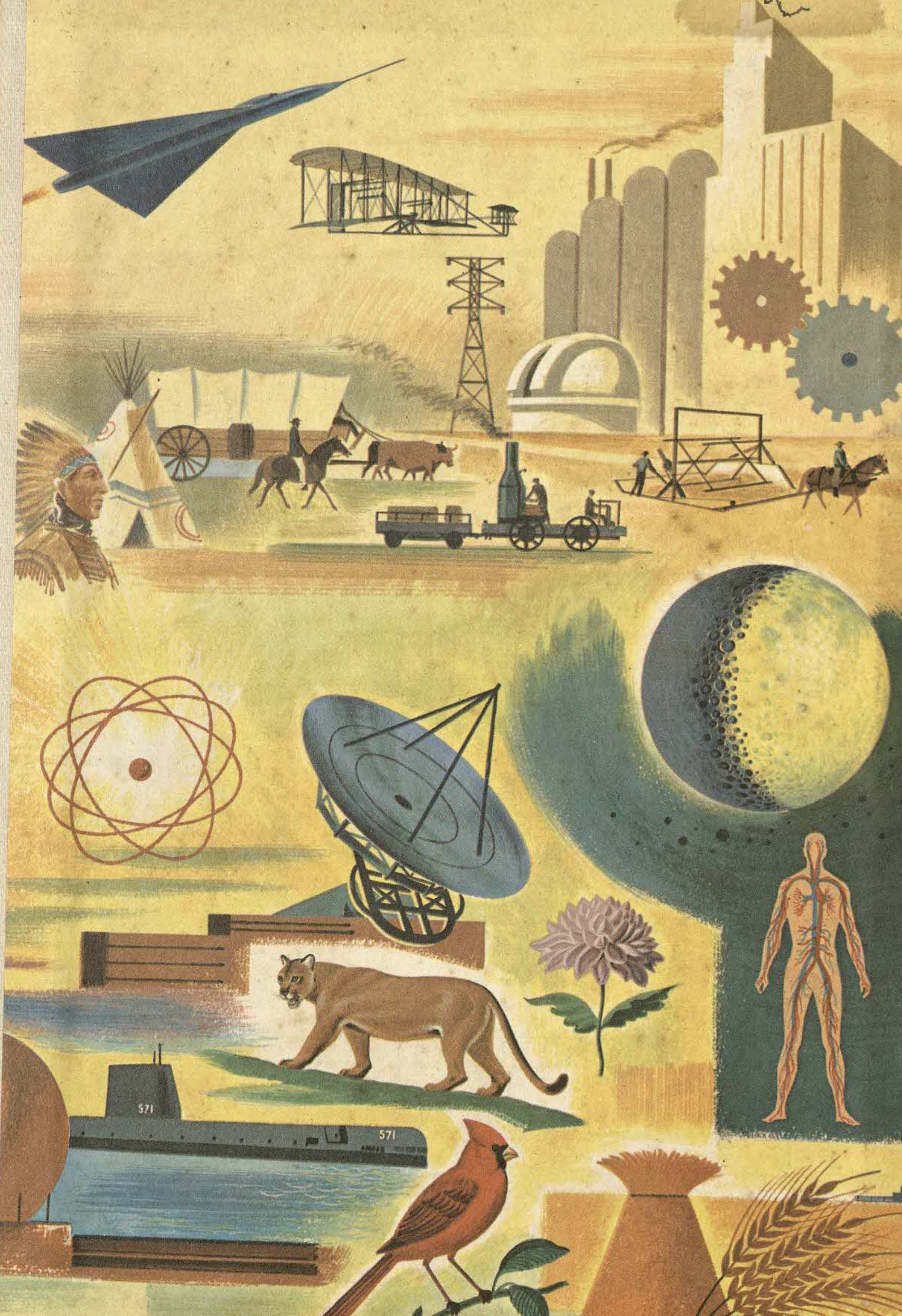
When he mastered the art, he gained fame by speaking against Philip, king of the neighboring state of Macedonia, and was present at the Battle of Chaeronea (380 B. C.), when Philip delivered the final blow to Greek independence.

When Alexander the Great succeeded his father, Demosthenes attempted to stir up a general revolt against the Macedonians, but failed. He was imprisoned on a false charge of accepting a bribe from the enemy, but escaped. Returning at the death of Alexander, only to see the Greeks again defeated, he fled to the temple of Poseidon, on the coast of the islands of Greece. There he committed suicide by poison.

Demosthenes' oration *On the Crown,* which is primarily a review of his political career, is considered by many critics as the most nearly perfect oration of all time. There exist today about sixty speeches attributed to him. Those delivered against Philip of Macedon, known as the *Philippics,* have added a term to our language; today we apply the name to speeches full of moral indignation.

DENA'TURED ALCOHOL. See ALCOHOL.

E=mc²
EINSTEIN


571
571